

The TOOL ENGINEER

JUNE 1954



Welding High-Temperature Alloys

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL



ENGINEERS



... Seen any lamplighters lately?

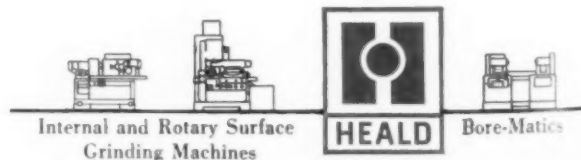
THE lamplighter's job seemed pretty secure... until someone discovered how to light a lamp without a flame; turn it out at the flick of a switch. Then the lamplighter disappeared — but a whole new industry was born.

For competition is at work everywhere, constantly directing the shape of things to come. Products that are better or less costly forge ahead — others are left behind.

Today, with competition rising to a normal, healthy pitch, manufacturers everywhere are seeking new ways to improve production and cut costs. That's where we at Heald can help you. In the vital matter of precision finishing, new Heald machines and advanced Heald engineering can often effect substantial savings—improve production speed and

product quality too! Ask your Heald representative about the latest developments in automation, simultaneous and progressive borizing, improved grinding and loading methods.

Competition is wonderful if you're *ahead* of it. Our business is to help keep you there. That's why **IT PAYS TO COME TO HEALD.**

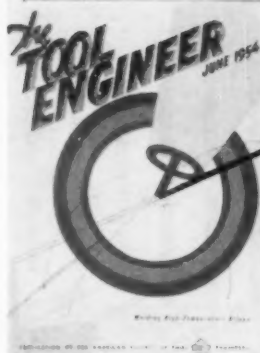


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Cover: High temperature materials are gaining in importance in military and civilian applications. Production welding processes for these materials are discussed in the article beginning on page 73.



The Tool Engineer

Volume XXXII, No. 6

June 1954

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Engineering Index Service and the Industrial Arts Index



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The Tool Engineer

Bully for Engineers!

Often, comments are heard expressing disappointment and a keen feeling of loss because an engineer has moved into full-time management or administrative duties. Barring the possibilities of putting round pegs in square holes, such appointments from the engineering profession to these important functions of industry are both desirable and commendable.

Not many years ago, the natural path to management and presidencies of corporations was through the legal profession. Then there were valid charges that the engineering viewpoint, with intimate knowledge of production processes, was neither appreciated nor understood at policy-making levels in industry. That picture has been changing rapidly and is resulting in thoroughly integrated and coordinated operations. In fact, progressive organizations are training their own personnel to fill the ranks of top management as vacancies occur and as the companies expand.

In addition to feeling responsibility for contributing to facets of industry other than engineering, the engineer should be conscious of the broadened background this involves. He must prepare himself in matters beyond the application of his professional skills. Important as these skills are in themselves, there are also the economic aspects of determining how effectively engineering developments can be utilized. Who could make better policy decisions than an engineer, eminently successful in his chosen field and cognizant of a public trust? He knows first hand about the practical and tangible factors involved.

Important as an individual is to his profession, his contributions to industry and to the public may be invaluable in the field of management. With each progression of this kind, the stature of engineering as a profession is enhanced and the aspects of engineering take on a broader viewpoint.

THE TOOL ENGINEER

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John W. Greve

EDITOR



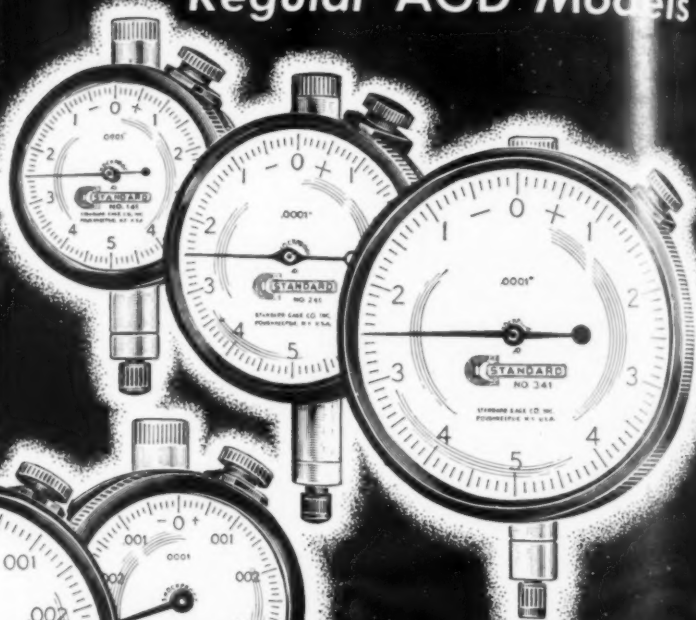
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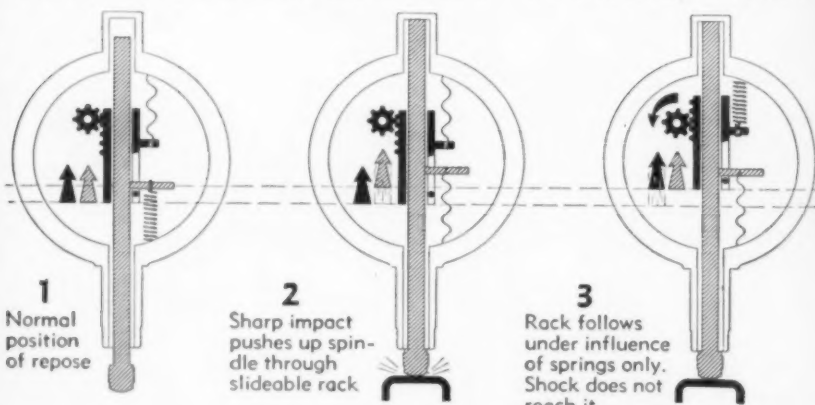


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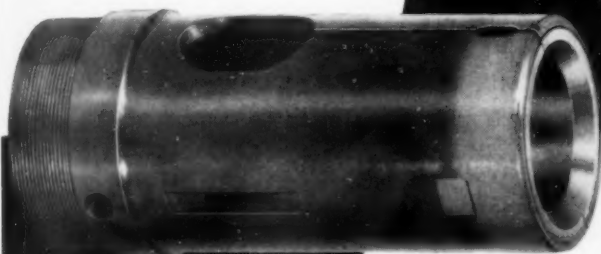
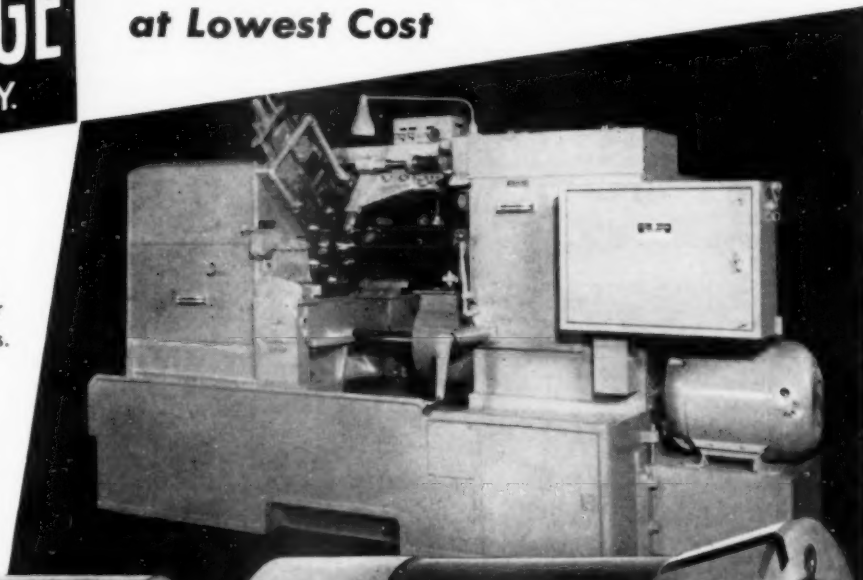
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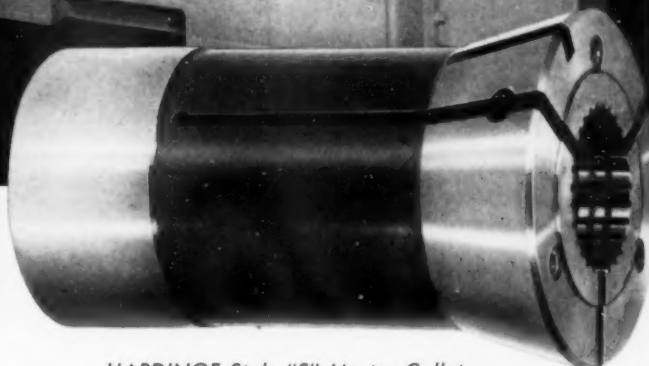
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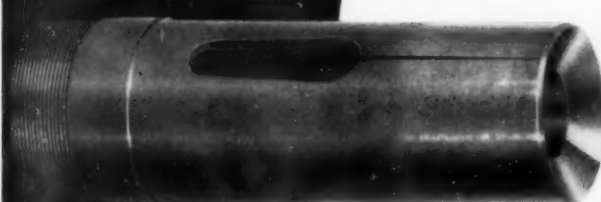
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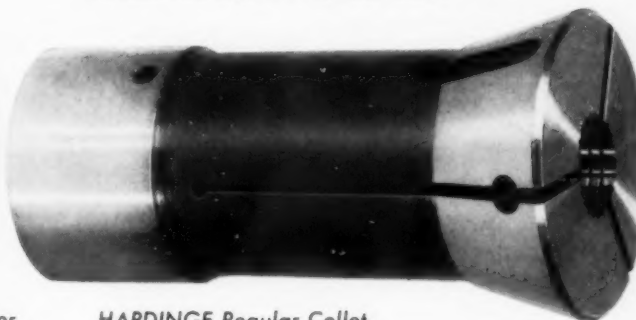
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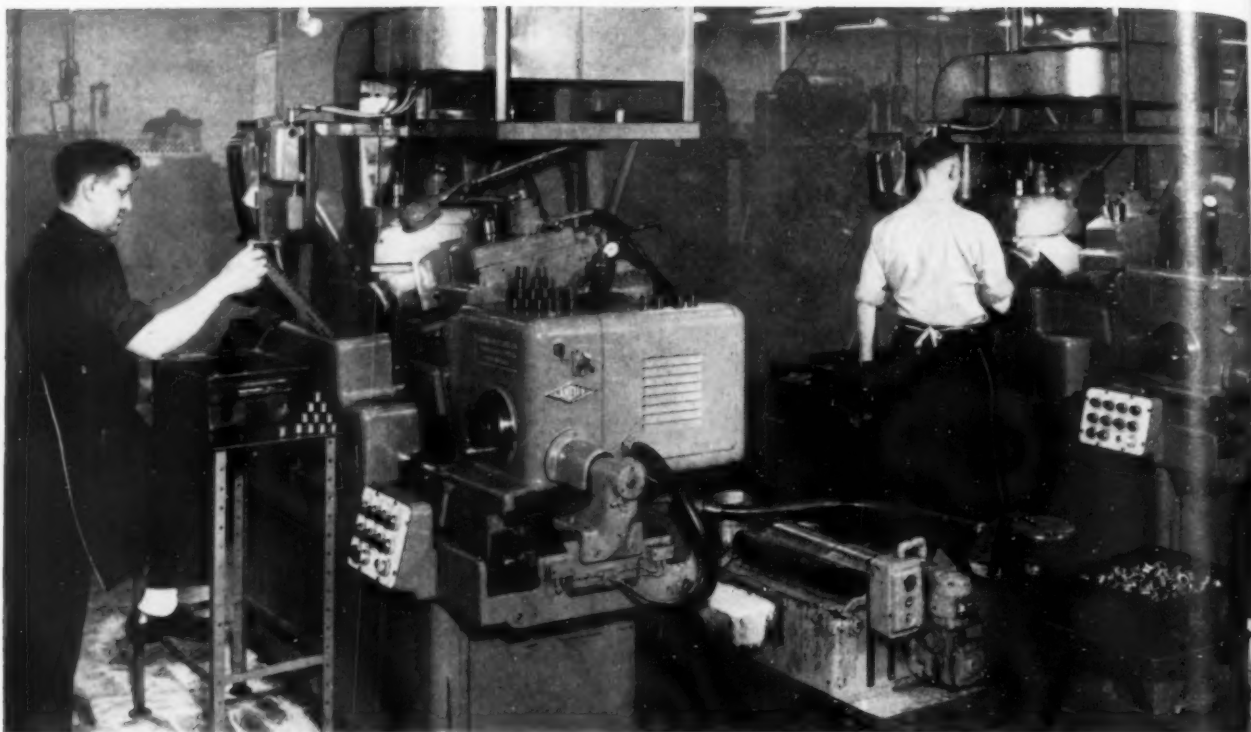


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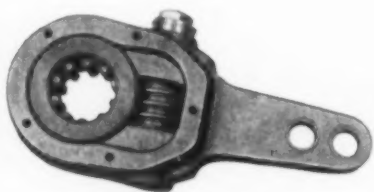


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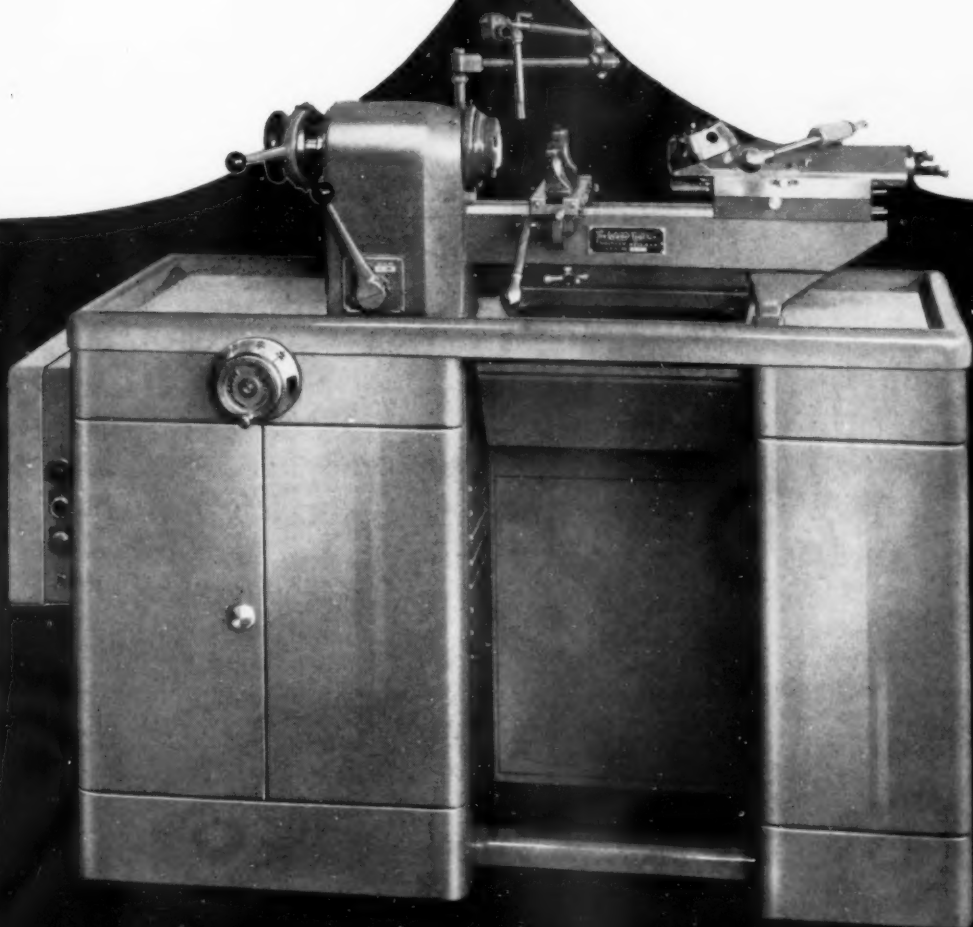
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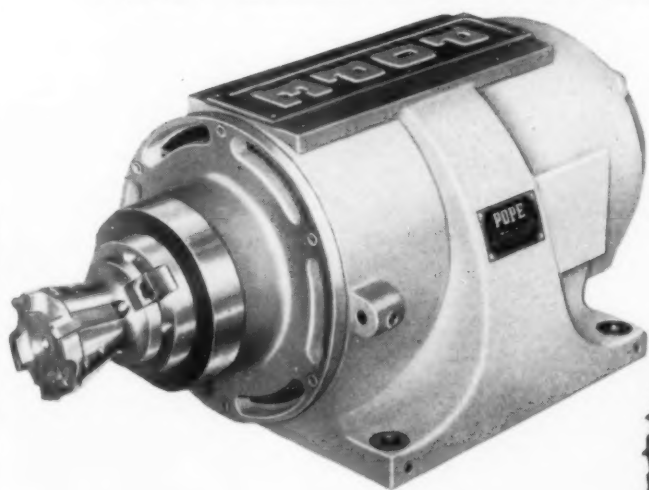
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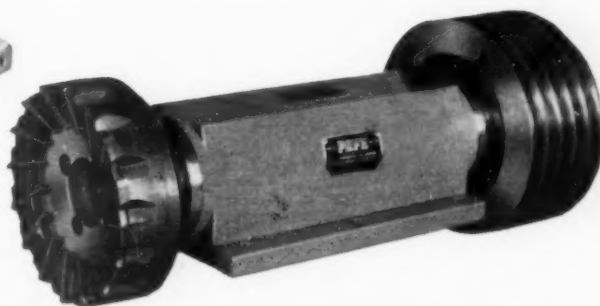
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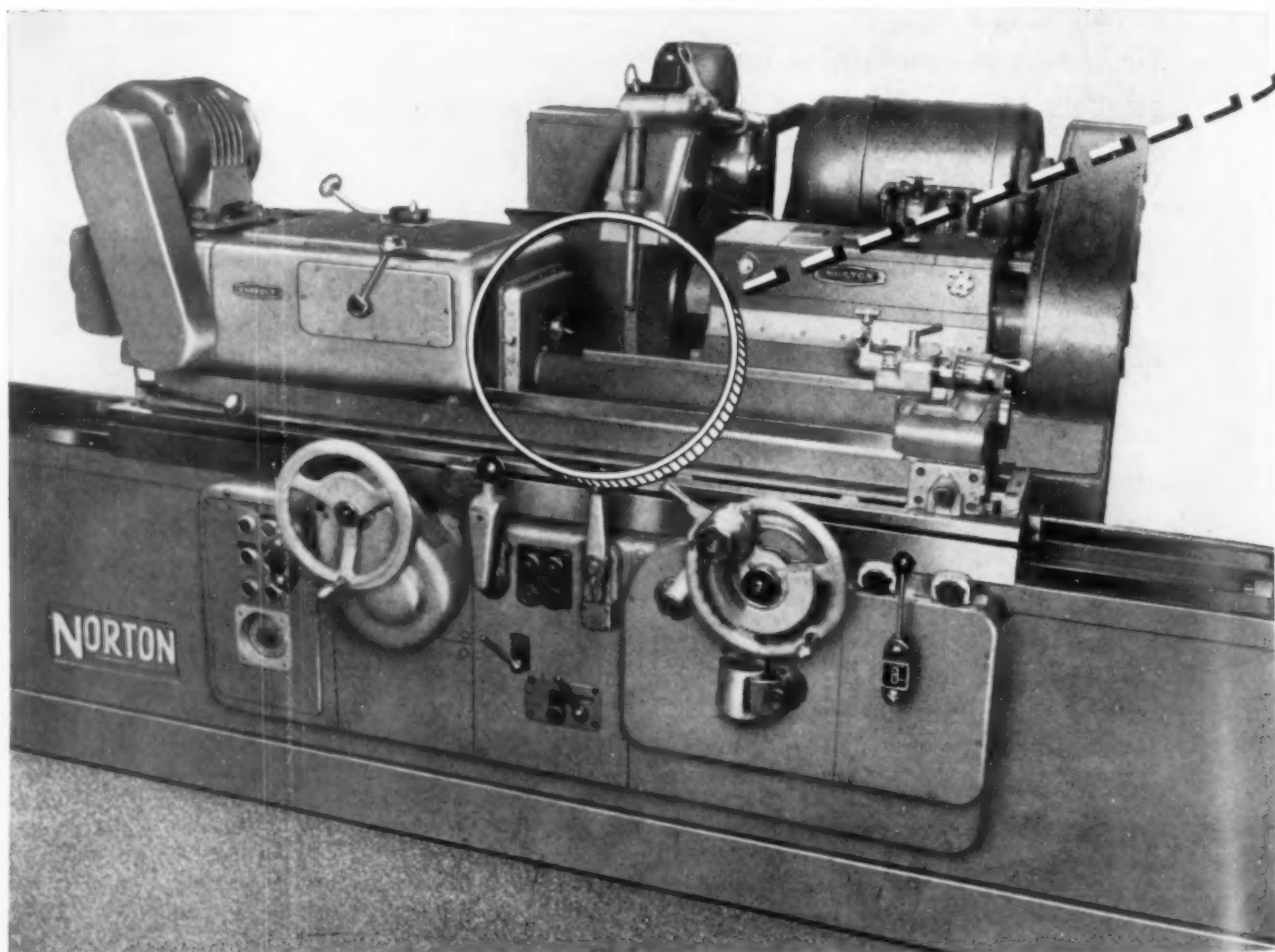
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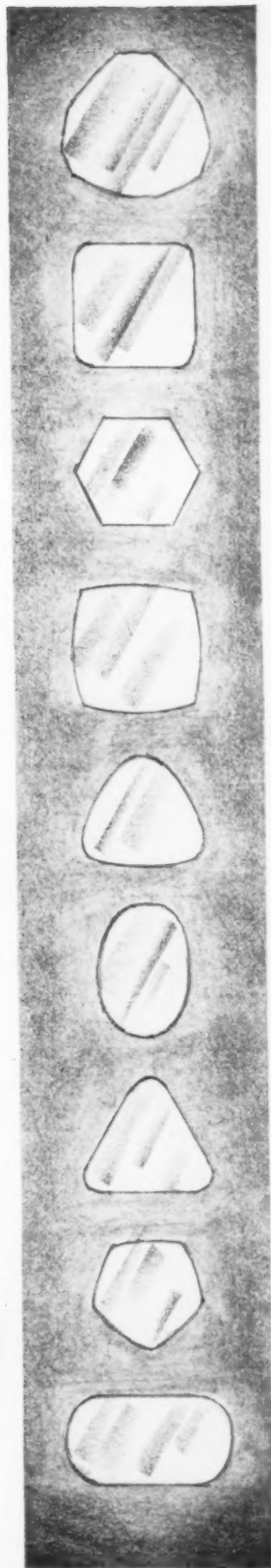
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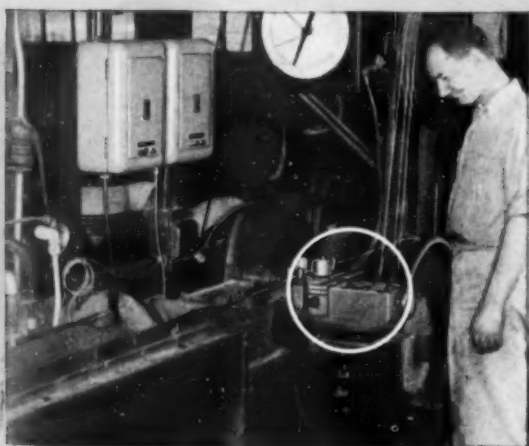
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3 Operations Total 2.4 Minutes

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1st Operation—0.6 Minutes

This rough machining prepares parts for holding and locating in subsequent operations. Bell-type centers in the tailstock and spindle line up hub diameter at each end. Longitudinal location is taken care of by a positive stop. A single tool on the front carriage turns the flange, while two tools on the rear slide straddle face.

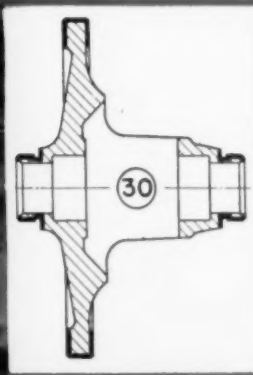
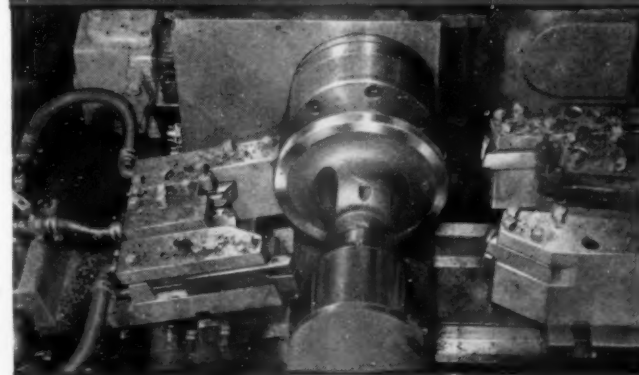
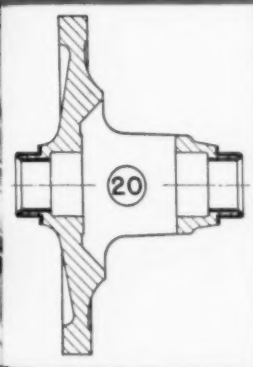
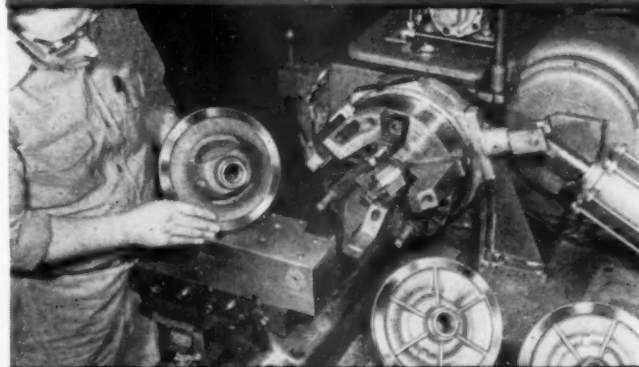
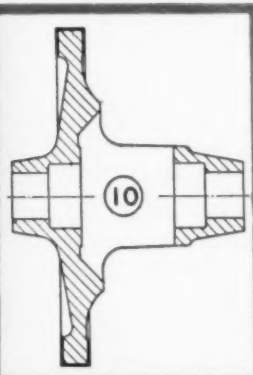
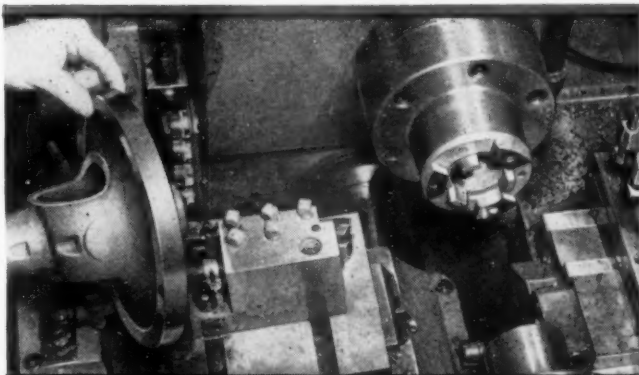
2nd Operation—0.9 Minutes

Part is now held on OD with a Gisholt-Barker air-operated chuck. This chuck leaves the spindle open to carry tools to bore, face, turn and chamfer the hub. Similar tools mounted on the front carriage handle the same surfaces on the other end.

3rd Operation—0.9 Minutes

Workpiece is held back and driven with an air-operated clamp and a serrated C-washer. Tools on front carriage turn both hubs, as well as finish turn the flange OD and chamfer both corners. Tools on the rear slide form the grinding relief, chamfer both hubs and finish straddle face the flange.

These complex parts, with 16 inside and outside surfaces at both ends, are machined in a rapid, pass-along sequence.



THE AMAZING VERSATILITY of this machine is illustrated by 28 different jobs in the No. 12 Hydraulic Automatic Lathe catalog. Write for your copy.



TIME- SAVING IDEAS

Combined Tooling Saves Time

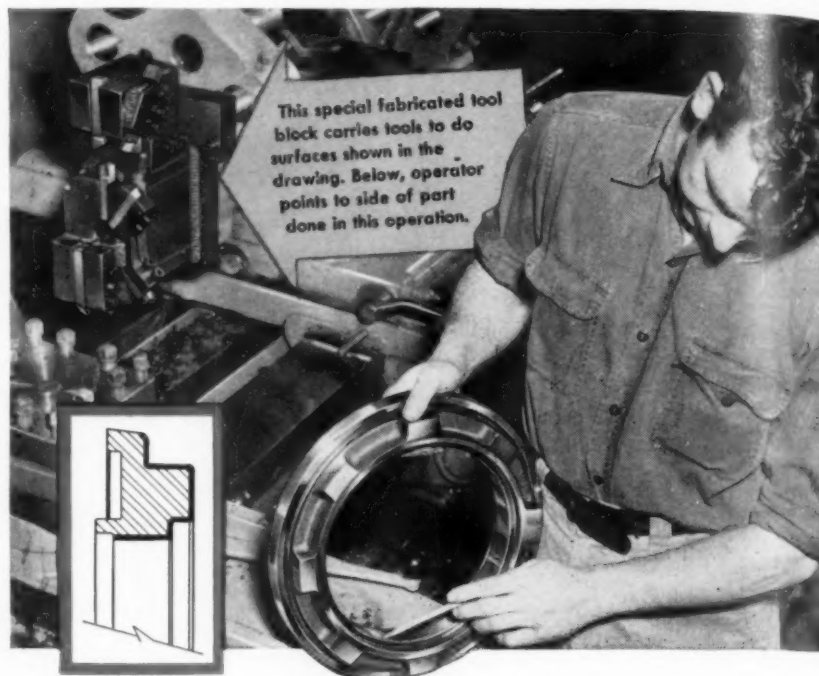
It's heavy work with plenty of metal to be removed in the machining of these flanged ring steel forgings. So there's 60 horsepower put into the 3L Saddle Type Turret Lathe that does the job.

A newsworthy feature of the setup—and a good point to remember for your own work of this kind—is the massive combination tool holder which carries seven tools. Securely mounted on the hexagon turret, this special head combines tools for plunge cutting the surfaces shown in the drawing in a single pass. Floor-to-floor time is 2.5 minutes, much faster than what it would be with a conventional tooling arrangement.

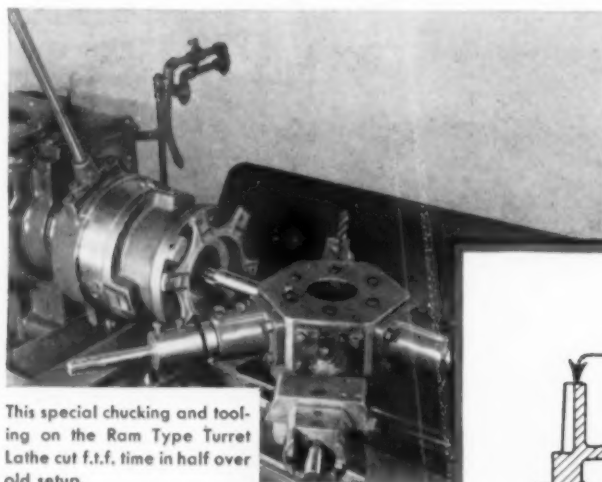
You can be sure that the tools mounted in this strong, fabricated head are there to "stay." There's no overhanging of tools this way, no springing problems. Work of this kind, to do it right...and fast...takes

plenty of power and rigidity in a machine. They have it here in the rugged Gisholt 3L Saddle Type Turret Lathe.

By combining 7 tools in one special head, all surfaces are handled in one powerful plunge cutting operation.



CLEVER CHUCKING IDEA HELPS DOUBLE PRODUCTION



Also Assures Concentricity of Long Workpiece

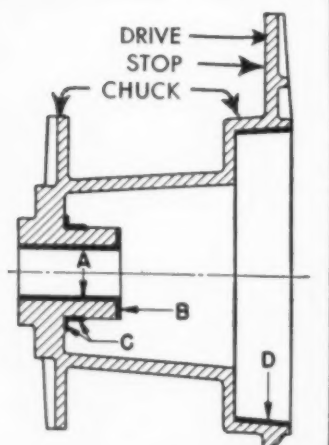
Here the production trick is holding these cast-iron hub spiders. Because of the long overhang, chucking had to be planned for support at both ends of the workpiece. Yet, fast loading and unloading were a must, too.

All problems are nicely solved by the No. 5 Ram Type Turret Lathe equipped with a 3-jaw Gisholt-Barker Wrenchless Chuck. This provides for fast loading operations, and yet allows a large enough bore to carry a pilot bushing for added support during boring.

A special fixture locates and drives at the spider end. Chuck jaws, free to move through openings at the back of the housing, hold on the small flange end. Balanced and piloted tools on the hexagon turret handle all the surfaces shown.

Time on this machine with good tooling and chucking is now only 3.2 minutes—just half the time of the former method.

Here, fine, fast chucking with good tooling for rapid stock removal has doubled production.



- Station 1—Rough A
- Station 2—Finish A, rough B
- Station 3—Ream A
- Station 4—Rough C-D
- Station 5—Finish B-C-D



MANY SURFACES AND SIZES NO PROBLEM...THIS WAY



TIME-
SAVING
IDEAS

Simplimatic Provides Automatic Operation on Jet Engine Part

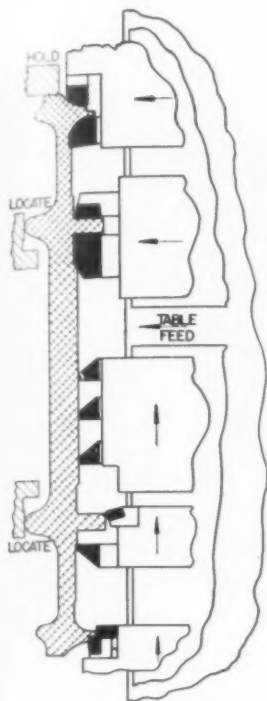
Setting up this jet engine job had its problems: how to handle the many

surfaces of the compressor discs in nine different sizes.

The solution was provided by a Simplimatic Automatic Lathe. Seven tools on the front slide feed longitudinally to depth and then across for facing and turning. Four tools on the rear slide move longitudinally to finish the turning and boring and to form the four radii. A 50-horsepower driving motor is required. Floor-to-floor time is approximately 13 minutes.

The drawing shows how each slide with its group of tools feeds at its own direction and rate of feed. This permits you to get more combinations of surfaces in a single tooling setup. It's the reason why so many different jobs can be handled on the Simplimatic—and at a cost far below that of a special machine.

Nine sizes of similar parts are easily handled by simply repositioning tools in the T-slots using the same slide positions and motions.



Tool setup and directions of travel.



GOOD TIPS IN HOLDING AND MACHINING BIG-SWING PARTS

Fastermatic Provides Efficient Production of 18 Similar Workpieces

There's more here than meets the eye. While the drawing shows simple multiple machining, there are definite problems in holding this part (and seventeen others) having considerable swing.

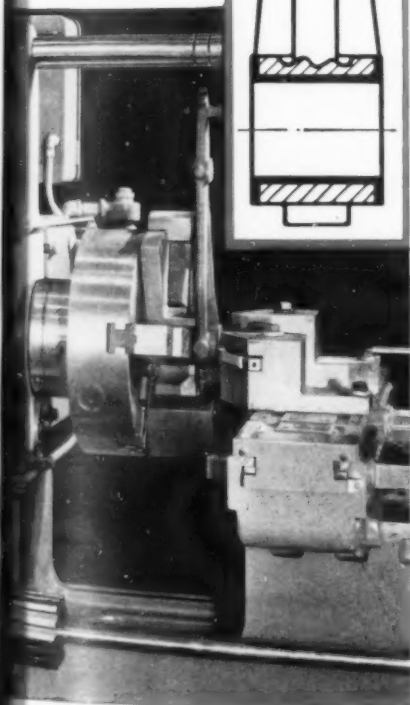
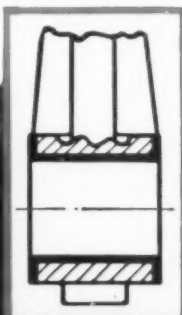
To do the job in one fast, automatic operation a 1F Fastermatic Automatic Turret Lathe was chosen because of the multiple passes it makes possible. To take care of the big swing, the lathe bed was gapped as shown.

The real problem—of holding the various parts without going into special, expensive fixtures—was solved

by a 2-3 jaw convertible chuck. Chucking is done with either two or three jaws, depending upon available chucking surfaces. To get a firm grip on the contoured chucking surfaces, jaw inserts are used.

There is simple turret and cross-slide tooling with a back-facing attachment mounted inside the spindle. This permits doing all surfaces from both ends in a single, completely automatic cycle. Floor-to-floor time for a part with an 18" swing is 4.7 minutes. The other seventeen parts are handled just as efficiently.

An unusual job with smart chucking permits machining these awkward, long-armed parts complete in one operation.



Close-up shows chucking detail. Front and back faces and the ID are machined in one operation.





TIME-
SAVING
IDEAS

SUPERFINISHER MOUNTS ON GRINDER

... SAVES REFINISHING COSTS

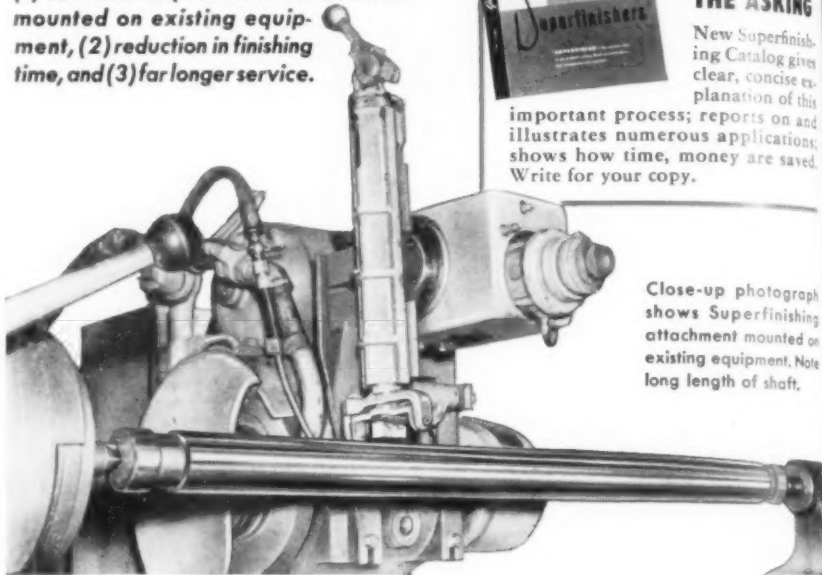
Smooth Surfaces Make Pump Piston
Rods Last Longer

Here is a fresh approach to an old problem—rebuilding worn pump piston rods.

First, the piston rod—from a reciprocating chemical pump—is placed in a grinder. The long shaft is then ground down to the top limit of undersize dimension. At this point, the surface finish measures approximately 15 micro-inches. The grinding wheel is retracted and with a No. 3 Superfinish Attachment mounted on the grinder, the surface is quickly Superfinished down to 5 micro-inches. Work is done in lots of six to ten pieces.

Two important benefits result: finishing time is cut in half with very little cost for new equipment; greatly increased service life is achieved with far less seal replacement.

In this better way of refinishing pump piston rods, money is saved by the (1) low-cost Superfinisher attachment mounted on existing equipment, (2) reduction in finishing time, and (3) far longer service.



Close-up photograph shows Superfinishing attachment mounted on existing equipment. Note long length of shaft.

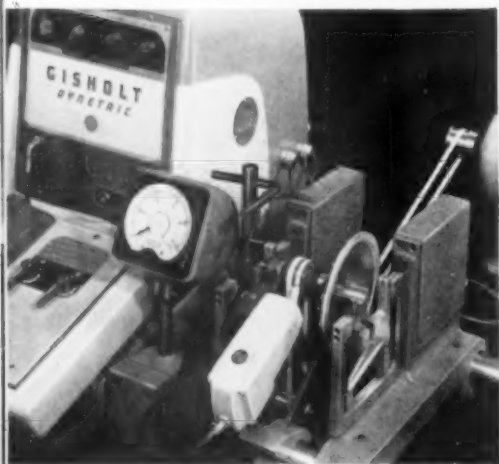
NEW!

YOURS FOR THE ASKING

New Superfinishing Catalog gives clear, concise explanation of this important process; reports on and illustrates numerous applications; shows how time, money are saved. Write for your copy.

HOW "FORCE" UNBALANCE IN ASSEMBLY IS LOCATED AND MEASURED

Correction Made by
Addition of Single Weight



Improved 1SB Bench Model Balancing Machine with workpiece loaded.

Precision balancing amounts to a real sales advantage in this case... vacuum cleaners. The manufacturer first dynamically balances the armature and then the armature-impeller assembly. Long life with smooth, quiet operation is the result.

Production is handled on a Gisholt 1SB Bench Model DYNETRIC Balancer. In this case, because the impeller is small in axial length compared in diameter, major unbalance after assembly with the armature will be *force* (static) unbalance, as opposed to *moment* (dynamic) unbalance.

The assembly is placed in a special cradle which permits it to rotate on its own bearing surfaces. Amount of force unbalance is shown on the direct-reading Amount Meter; and

angular location is simultaneously indicated on the numbered band by the stroboscopic lamp unit.

Correction of force unbalance requires the addition of a single correction weight. Time in making correction is therefore saved by the Gisholt Balancer because it provides separate measurement of force and moment unbalance. On jobs where moment unbalance stops within an established tolerance for most pieces in the lot, this kind of operation results in even lower balancing costs.

By showing force unbalance separately, correction time is saved by Gisholt Dynetric Balancers.



No. 5-654
625



THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Write for your copy of Gisholt's new general catalog.

GISHOLT
MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

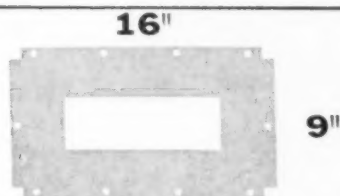
with a **WIEDEMANN** you can

***Reduce* INVENTORY & STORAGE SPACE!**

produce parts as required.

All
38
 PIECES
 were pierced
 in
 1/8" mild steel
 IN
28
 MINUTES
 (including
 all
 set-up)

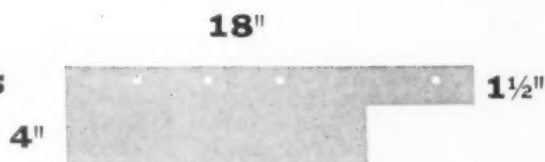
12 LIKE THIS



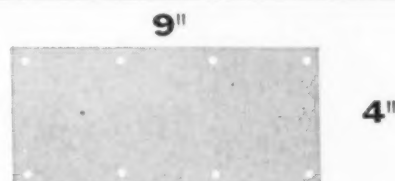
10 LIKE THIS



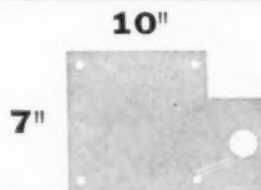
8 LIKE THIS



2 LIKE THIS



6 LIKE THIS



The company producing the above parts has eliminated inventory of these and many other items; has greatly reduced inventory of punches and dies—and they no longer need to stock templates.

The Wiedemann method enables them to ship parts directly to assembly rather than the stockroom.

Items are produced weekly or more often if necessary. Sizes of parts pierced on the Wiedemann range from 5 ft. by 10 ft. down to 2" squares.

Inventory and storage reduction are just two of many cost-reducing features of Wiedemann Turret Punch Presses. We'll gladly make a time study on your own work.

WIEDEMANN MACHINE COMPANY

4245 Wissahickon Avenue, Philadelphia 32, Pa.

**SCULLY
JONES**

"Precision"

give you a bet

New "TOOLITROL" speeds setup and tool changes! Here's a new tool control method that eliminates time-consuming tool adjustments in multiple-spindle machines, and obsoletes the cut-and-try method. You minimize downtime and keep machines operating at near capacity with "TOOLITROL." It co-ordinates your at-the-machine problems of presetting, storing, and changing tools. Scully-Jones "TOOLITROL" is engineered to your job requirements. Cabinets are made of sheet metal, pebble gray finish, mounted on steel benches with hardwood tops. Tool panels are chrome plated and are outlined with metal strips... red to indicate left-hand stations and blue to indicate right-hand stations. Name plates identify tools stored for each machine station. Various types of counters, with or without signal lights, control tool changes. Standard Flush Pin and Height Gages with Gage Plate speed pre-setting tools accurately to your job requirements. Write for Bulletin 19-50.



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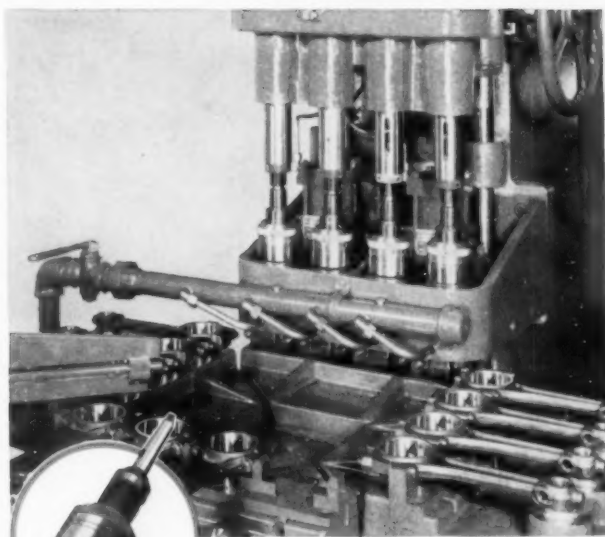
"Holding" Tools

better, faster setup on every job!



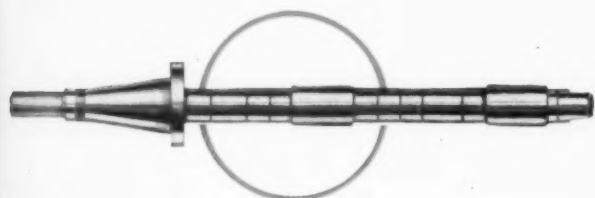
**New Safe-Torque Tap Driver
reduces tap breakage up to 100%**

At Caterpillar Tractor Co., Scully-Jones Safe-Torque Tap Drivers made possible a 25% cost reduction, 10-12% manpower saving, 5% production increase, and 400% increase in tap life. You can save, too, by controlling adverse tapping conditions with this new adjustable Tap Driver because it releases instantly and completely when torque reaches the danger point. Write for Bulletin 20-50.



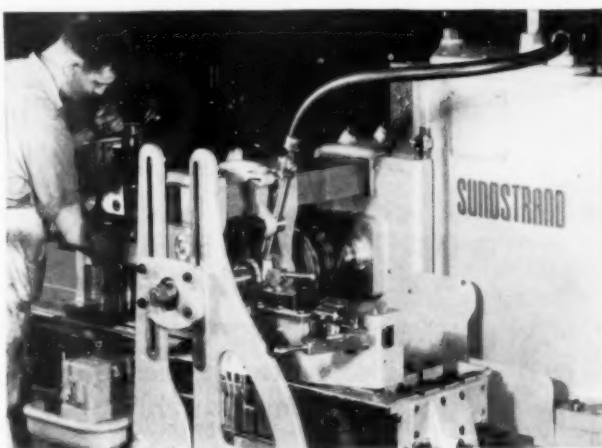
**Chamfers rods on two sides
in one operation!**

At Studebaker Corp., Scully-Jones Automatic Recessing Tools prove their accuracy and speed. Each cycle they produce two chamfers in four connecting rod bores. The position of cutters for location and depth of cut is controlled within .001". Perhaps you have similar operations you can combine and simplify by using these Automatic Recessing Tools. Write for Bulletin 10-50.



**Rugged Arbors assure long
tool life at high speeds!**

Rigidity of machine and tooling is a must for gang-milling these tough steel forgings . . . 46 per hour! Sundstrand specified Scully-Jones Style "B" Milling Arbors because they're tough and precision built to run true during fast, heavy cuts. Take the gamble out of milling with Scully-Jones Arbors and Adapters. Write for Bulletin 2-50.

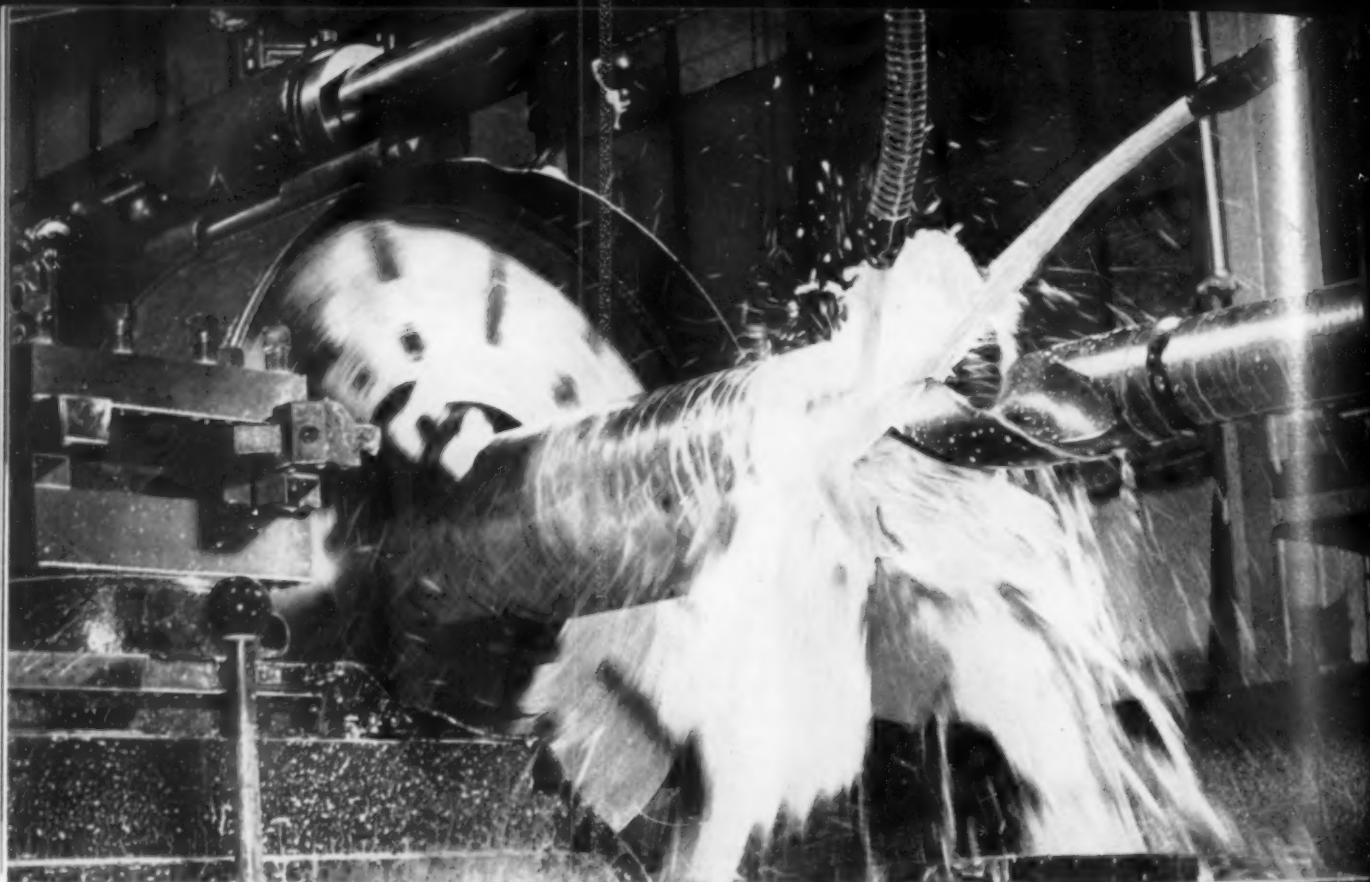


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SCULLY-JONES

"Precision Holding" for holding precision

Call Scully-Jones local representative or distributor—factory-trained "Precision Tool and Work Holding Specialist"—for complete information and service.



CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

Now Better Than Ever!

Sunoco Emulsifying Cutting Oil

New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding



IXES BE
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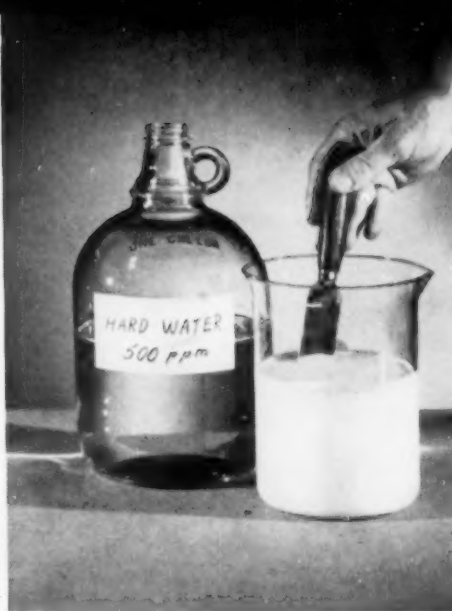
GRINDIN
surface
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MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.



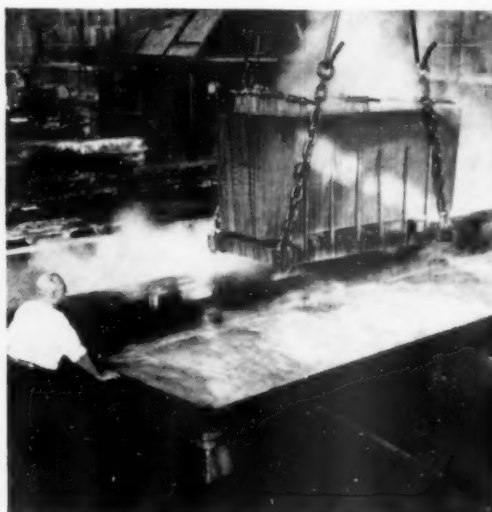
MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.



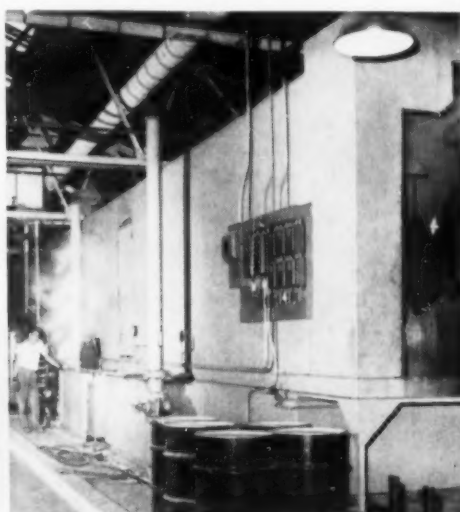
MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.



GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.



RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.



WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. TE-6.

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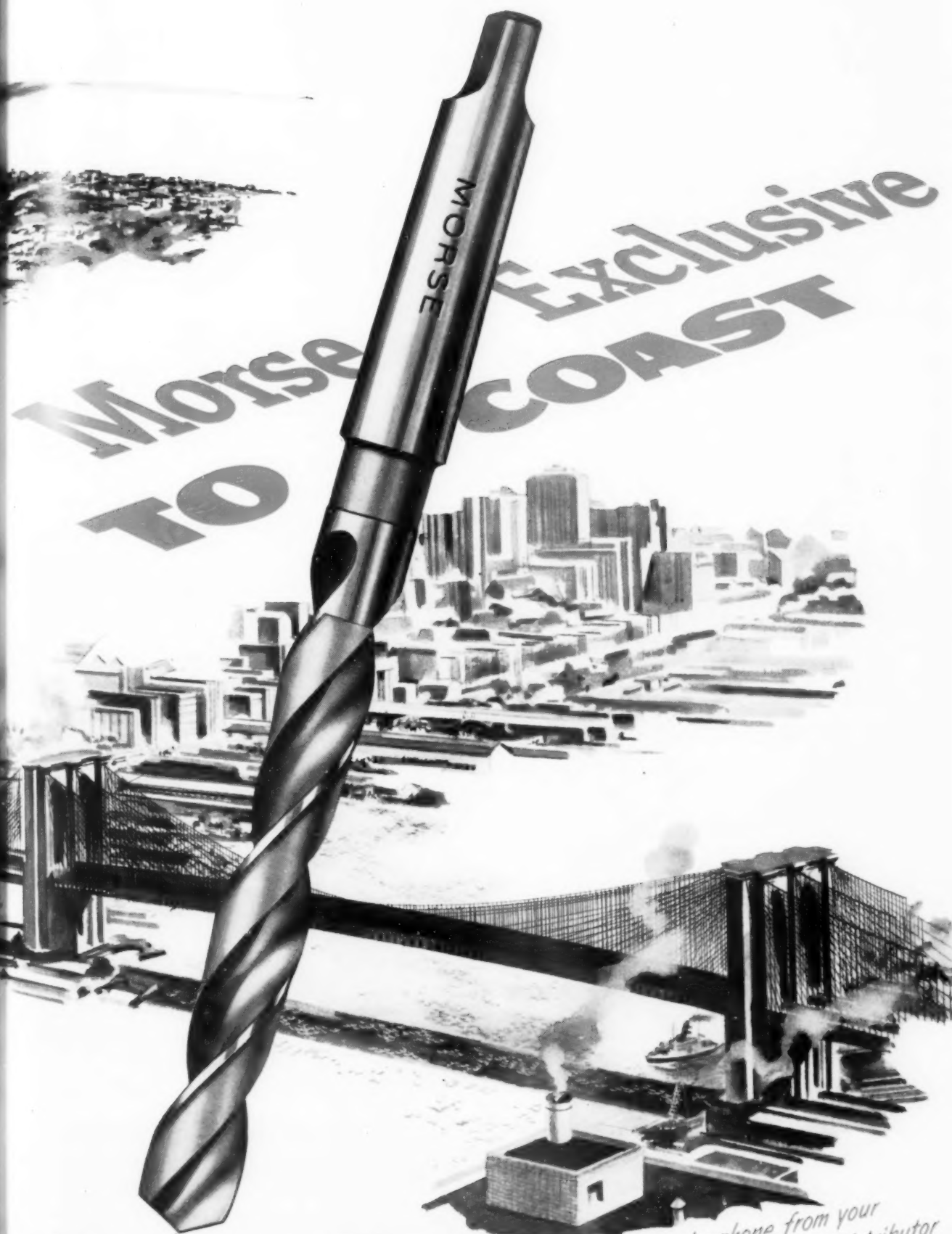
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you can profit by this extra tool life and performance... it pays to consult your Morse-Franchised Distributor on the application of Morse *Electrolized* Tools to your own particular needs. He has the practical knowledge... and he's backed by the top line and the top engineering service of the cutting tool industry.

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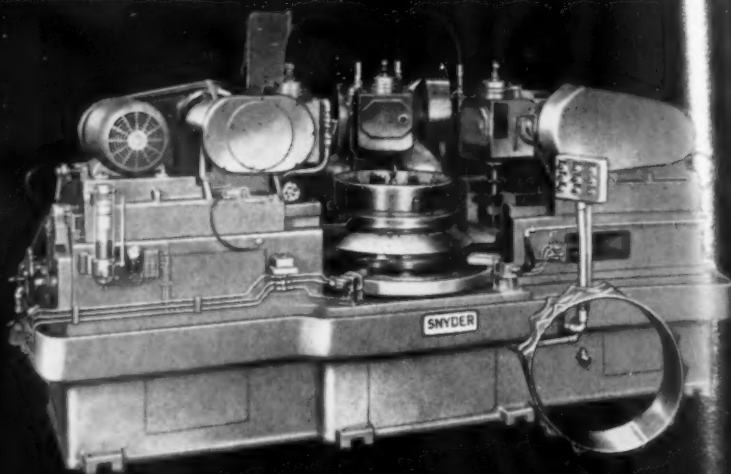
MORSE



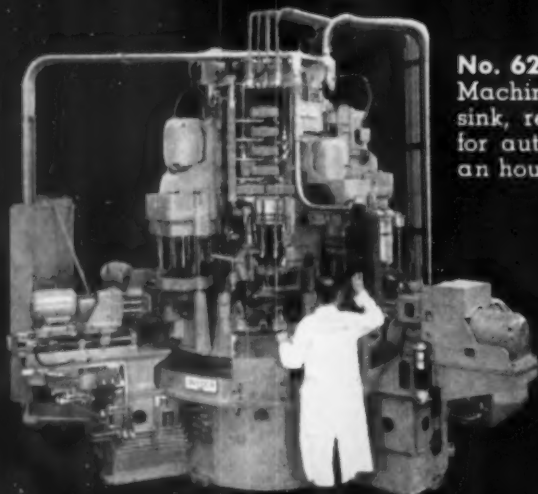
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*Buy them by phone from your
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and save ordering time*

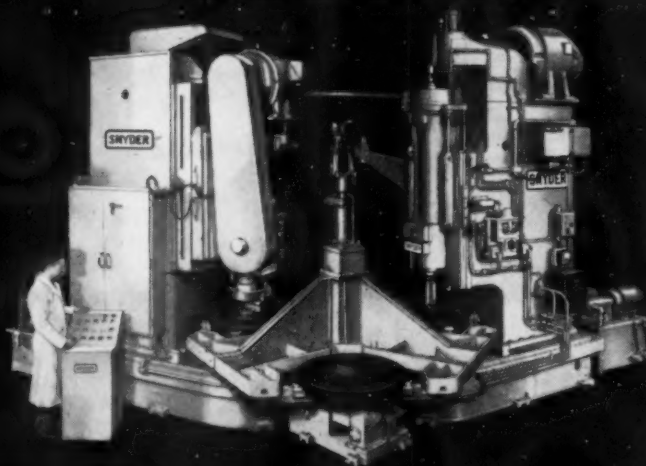
No. 68326—A three-way machine to profile mill four rows of lugs on a compressor casing for jet engines. 135 minutes are used to perform this operation in 3 steps.



No. 62207—Six Station Center Column Machine to drill, counterbore, counter-sink, ream and tap converter housing for automatic transmissions. 91 pieces an hour at 80% efficiency.



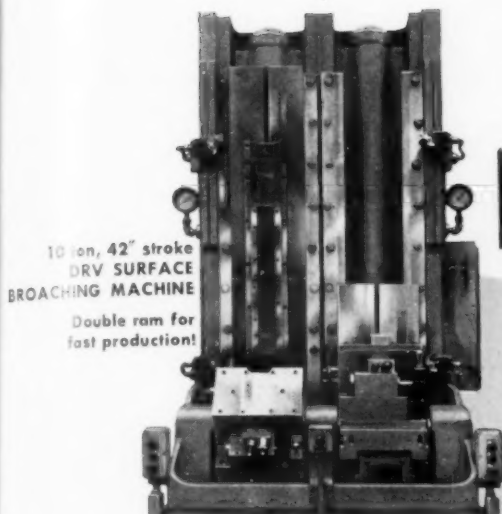
No. 67677—Two-Station, Vertical Column, Boring and Facing Machine to rough bore and face the hub of heavy railroad car wheels. Bore $6\frac{1}{4}$ " x 7" long. 33 units an hour at 100% efficiency.



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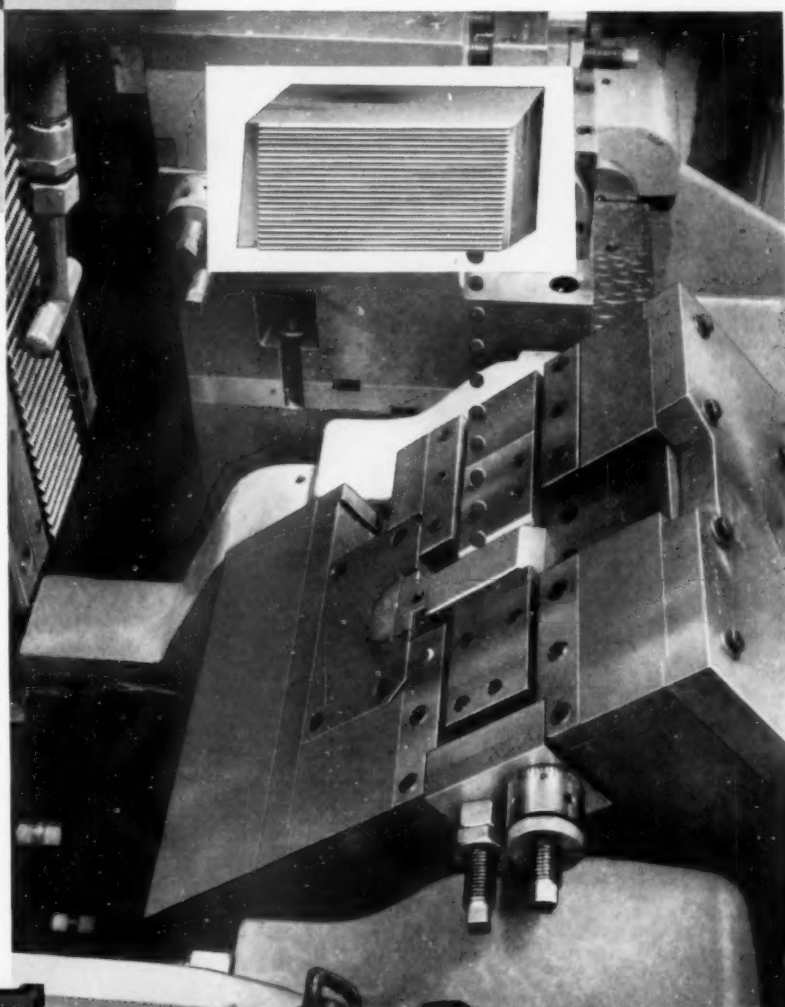
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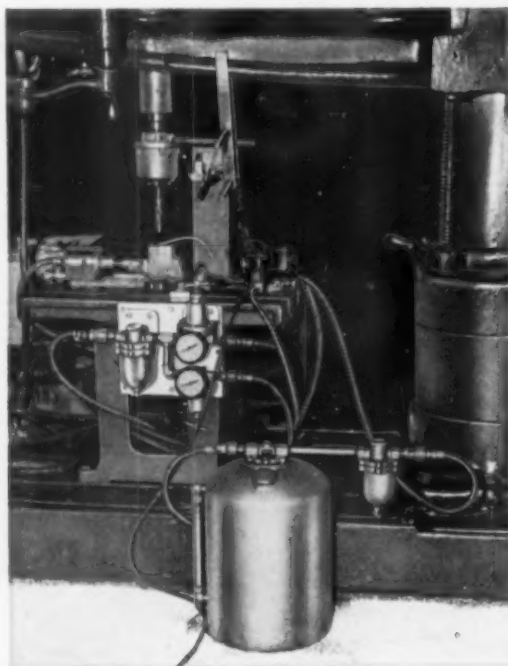


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NEW *Norgren* **Spray -Lube** *System*

increases output 35%
improves quality
eliminates hand operation

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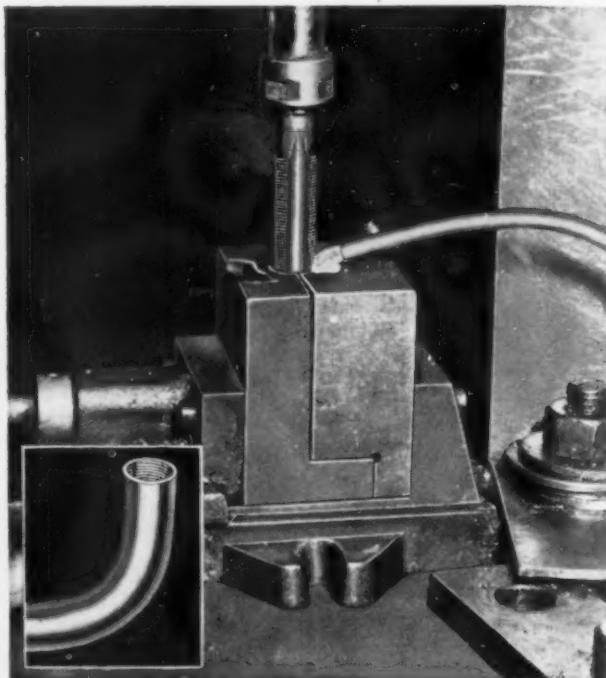
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VALVES FILTERS HOSE ASSEMBLIES REGULATORS LUBRICATORS

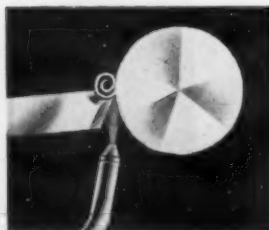
applies special compound for
tapping 100% thread in thin-wall
aluminum tubing



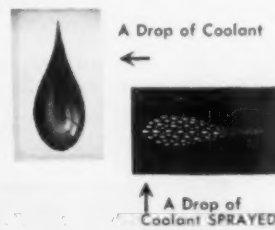
Norgren Spray-Lube System gives more
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on tapping machines, drill presses, milling machines,
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Coolant where you need it
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critical contact areas between
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Fine spray rapidly dissi-
pates heat... the spray lubri-
cates tool more efficiently; has
greater exposed oil surface
area for fast, thorough dissi-
pation of heat.

PRATT & WHITNEY

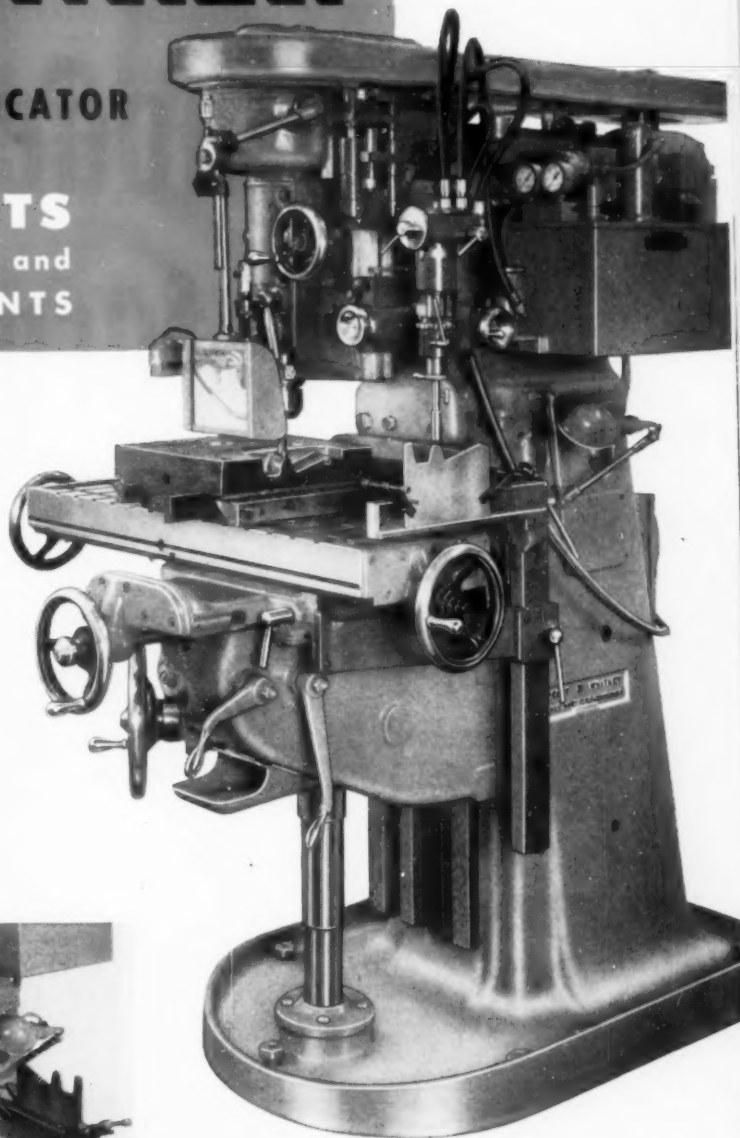
2B DIE SINKER

equipped with
GOODRICH HYDRAULIC DUPLICATOR
produces
ALL CHERRYING CUTS
with inexpensive shank-type cutters and
WITHOUT EXTRA ATTACHMENTS

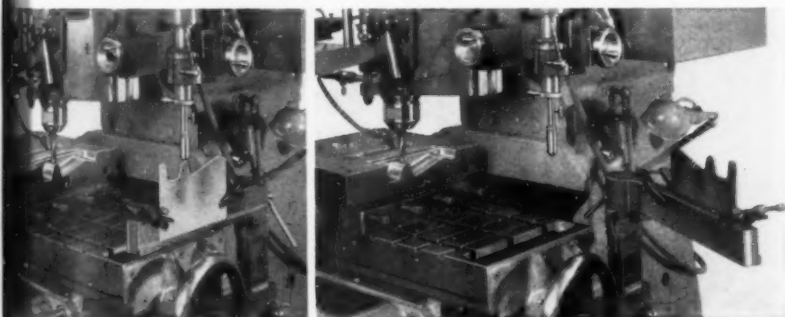
TABLE WORKING SURFACE: 12" x 36"

Fast, accurate and reliable, the Pratt & Whitney 2B Plain Die Sinker equipped with the Goodrich Hydraulic Duplicator simplifies and speeds up all die sinking jobs. Working from a full, 3-dimensional model or an inexpensive, easy-to-make template, the 2B Machine faithfully duplicates all curves and angles of the master form. Many more types of cuts can be made, using inexpensive shank cutters, than are possible with the conventional cherrying attachment; there is an infinite range of radius cuts . . . concave or convex. Much layout work is eliminated. Operation is convenient with cutting action under complete control at all times. Fatigue is greatly reduced, productivity increased.

The P&W 2B Die Sinker is also available without the Goodrich Duplicator but with the necessary mounting pads should you wish to add this feature later. If die sinking is an important part of your operations, the 2B is a "must" for your modernization and replacement program.



Shape of the template is accurately duplicated in the die block. As shown at the right, template can easily be swung out of the way.



SEND FOR COMPLETE
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. . . see how the 2B Machine
can help to make your die sink-
ing operations more efficient,
more profitable. Write today
on your Company letterhead.

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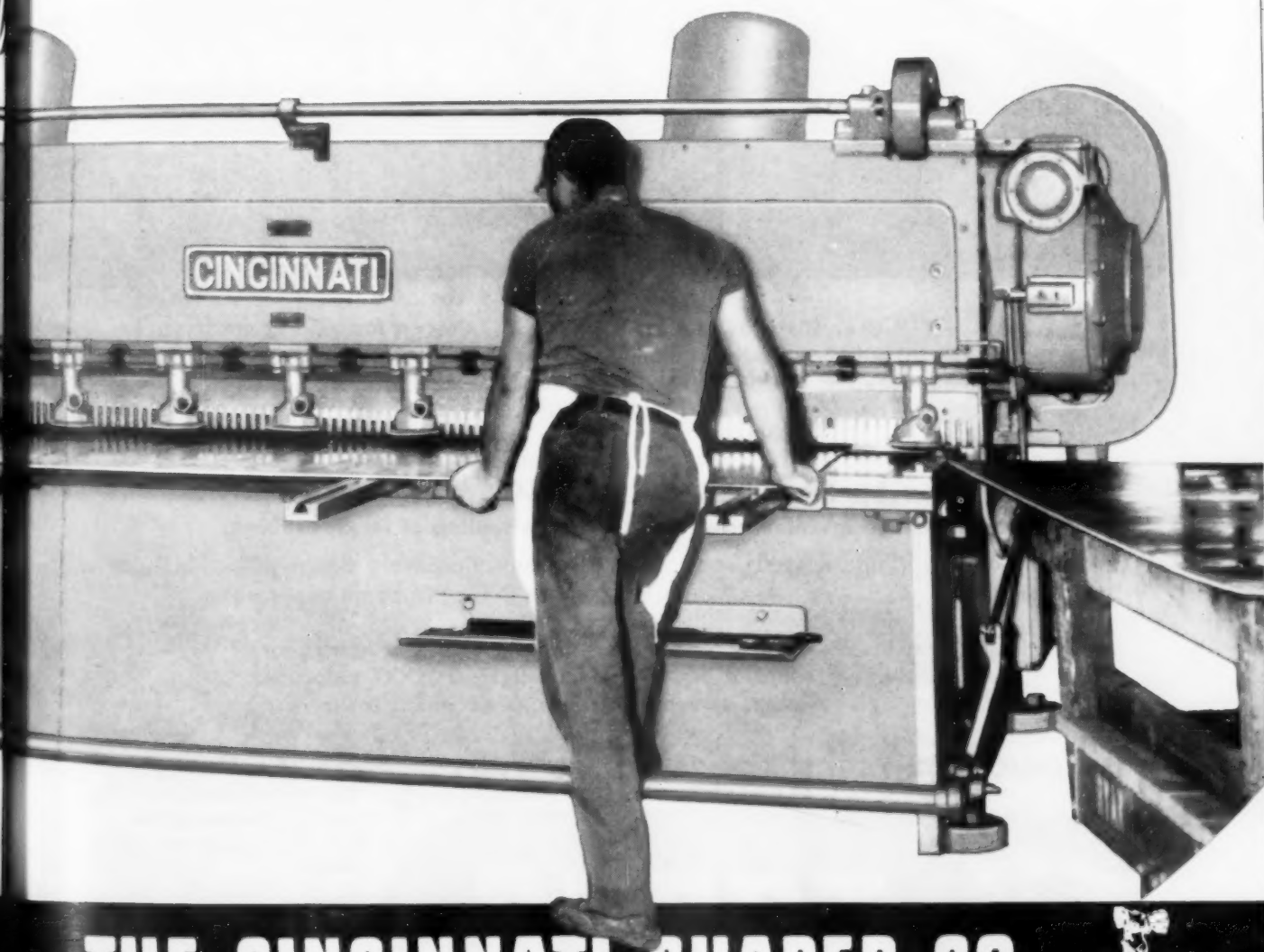
modern machines MAKE modern furniture...



Photos courtesy The Troy Sunshade Company, Troy, Ohio

In this modern furniture factory, modern Cincinnati Shears give an accurate, economical and versatile performance. Ease of operation, rapid, simple gauging, holding work securely and clean cutting, all speed production and reduce costs.

Write for Cincinnati Shear Catalog S-6.



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CINCINNATI 25, OHIO, U.S.A.

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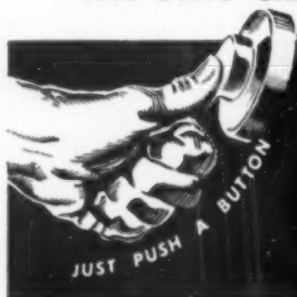
at 250'
per minute
in Regular Production

Yoder-TOCCO mills, using the patented TOCCO Process for welding ferrous pipe and tubing are actually producing pipe at speeds of 150 to 250 feet per minute. This rate is almost twice as fast as any other cold forming pipe mill in production anywhere in the world. *Check these advantages:*

- ✓ A production speed of 200' per min.
- ✓ lower cost because of increased production and lower maintenance.
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The Tool Engineer

Twenty-Second Annual Meeting and Industrial Exposition

We have just concluded our 22nd Annual Meeting with one of the most forward steps in our existence. This advance took place during the meeting of the House of Delegates. I am referring to the improved status of the National Delegate in our Society. From now on, he will be a real liaison between the individual member and the National Officers and Directors. He will be better informed on the decisions and duties of the officers and directors. He not only will keep his own chapter informed, but also will be welcomed at neighboring chapters. The chapters will consider him as the immediate link with the Directors and National Officers on affairs of policy.

The Chapter Chairman will still have the full power of his office in accordance with our Constitution. Should he need guidance, he will have it handy by referring to the National Delegate. These one hundred fifteen national delegates will have active participation in their chapter affairs all year long, and we are bound to have the thinking of the 30,000 individual members expressed to our Officers and Directors.

I want to mention one more outstanding event of our past meeting: The thirty technical sessions that were attended by over 6200 members and friends of ASTE. The seriousness of purpose of our membership in their desire for knowledge is well known, and the amazing attendance at these sessions bears out this fact.

Our thanks are given to the host chapter members that made this meeting so successful; to the exhibitors for displaying the latest in technical know-how; to the headquarters staff for their many hours of extra work in preparing this outstanding exhibit; and to the employers of our members who so willingly make it possible for them to improve their knowledge at the technical sessions and the show.

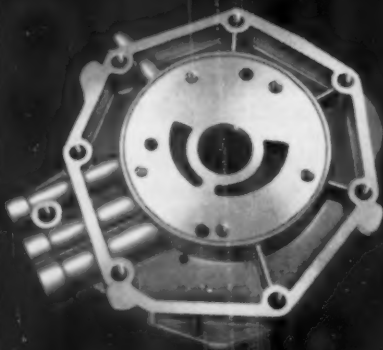
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1954-1955



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preventive maintenance

TRIMS PRODUCTION COSTS

By **Ralph H. Eshelman**
Associate Editor

WITH THE DEVELOPMENT of automatic manufacturing processes such as automation and extensive assembly lines with split-second scheduling, production men everywhere have become acutely aware of the necessity of preventing breakdowns. Though preventive maintenance is widely discussed, apparently considerable confusion exists regarding what a good program should be. It has been described as everything from a lubricating schedule to a filing system. Too often it is largely theory which receives only lip service.

Faced with rising manufacturing costs and increasing complexity of production machinery, the Ford Motor Co. turned to the maintenance department of plant engineering for help. The result has been a soundly designed and practical plan of preventive maintenance under the leadership of Owen A. Williams, manager of maintenance.

Essentially, according to Mr. Williams, preventive maintenance is the scheduled servicing of equipment and facilities to prevent failure. It is his belief that a good preventive maintenance program is the heart of high volume production. While attention of management is focused primarily on production output, it in turn is largely determined by the kind of maintenance job that is done. Without planned maintenance, unscheduled repairs must be made causing serious loss of output and disruption of production schedules. Or a machine requiring only minor attention is allowed to operate until major repairs are necessary.

In today's mechanized manufacturing processes, the maintenance operation is a large part of the picture, *Fig. 1*. In an organization of this size maintenance costs run into millions of dollars a year and thousands of men are employed in these activities. A reduction in these costs will therefore add directly to the profit column. While it is im-

possible to assess accurately the total costs of lost production and other indirect factors, it appears probable the preventive maintenance program will provide the equivalent of a 10 percent cost savings in maintenance expenses.

Objectives of Program

For instance, in one operation where a preventive maintenance program has been installed, it has been possible for the maintenance group to assume responsibility over a 2-year period for approximately 20 percent more equipment without an increase in the manpower. Maintenance in the past

Fig. 1. Automation equipment such as this crankshaft drilling machine has made preventive maintenance a necessity for many companies.



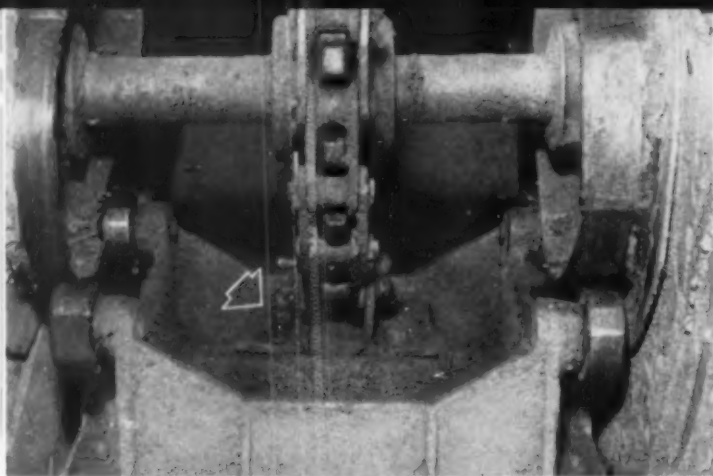


Fig. 2. (left) Engine assembly line was shut down because shear pins were broken due to loose fastener.

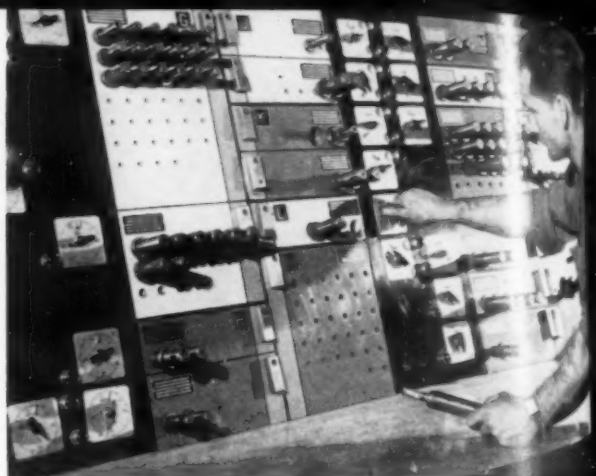


Fig. 3. (right) Tool control board in Ford's Cleveland engine plant stores tools and records life of tools in operation, providing a method of handling preventive maintenance in keeping with new equipment.

was based on repairing equipment after it broke down. This approach is unsatisfactory today. The entire production system is geared to a uniform production rate per hour and there is no possibility of making up parts loss due to breakdown. The entire production line can be shut down because of one small element, Fig. 2.

Preventive inspection could have discovered the loose fastener and scheduled the repair before failure occurred. Because the fastener was not tightened, the conveyor jammed, breaking the shear pins. Thus, an emergency repair was required and a production loss occurred.

By preventive inspections on welding equipment in one division, down time has been substantially reduced. Loose and defective cables, transformers, etc. are repaired before trouble starts. Welding tips are dressed during normal down time such as lunch time. In another plant, there were frequent breakdowns on 250-ton presses prior to installation of preventive inspections. Each breakdown removes the press from production for about four days and parts replacement costs approximately \$800. Preventive inspections have eliminated most of the lost time and replacement costs. Increased machine life is a natural result of reduction of abnormal wear on machine parts such as clutches, ways and cranks. Those requiring only a little attention are found through periodic inspections. Corrective measures can be taken immediately increasing the life of a machine.

Standard tools are used wherever possible to hold cutting tool change time to a minimum and an automatic tool control board is used in connection with automation equipment, Fig. 3. This is a recent development already accepted as an outstanding feature of the maintenance program. By means of this system a supply of tools for a given transfer machine is kept near the machine. A definite location

is established in the board for every tool used. Each tool in the board has been preset in accordance with company standards so that it can replace a worn-out tool without adjustments on the machine. Each tool is represented by a tool meter dial connected to the machine. The pointers on the dial are set on a predetermined number of pieces depending upon the known life of the tool, just prior to the need for a regrind. When any particular tool has reached the predetermined number of pieces the machine is automatically shut down. By scanning the tool control board, the setup man determines readily the tools requiring changes. He selects other tools to change at the same time where the indicator pointer has reached the red area. By this method of changing tools a great saving is realized because fewer tools are broken, smaller quantities of production parts are sent to salvage for repair and machine down time is held to a minimum.

Another long term result of preventive maintenance is leveling in manpower needs. Through forehand knowledge of major repairs and overhauls, developed by the replacement scheduling and reduction of emergency repairs, it is possible to anticipate labor needs and spread work loads.

Reduced material usage, another benefit of this program, is achieved in many ways. The life of a major part of a machine can be substantially increased by proper servicing. A typical example was the discovery of a hot bearing on a stamping press during preventive maintenance inspection. Investigation disclosed a lack of lubrication. By repairing the damaged lubrication line, the bearing and possibly shaft were saved from serious damage.

By analyzing repeat repairs, design changes have been recommended and made, resulting in a reduction of maintenance repair work. For example, the average flywheel bearing life on a large press was increased 200 percent by improving the lubrication system. In another instance, tapered bearings on spindles of hobbing machines were constantly being changed and the bearing holders scrapped because of varying seizures. It was discovered that the seizures were caused by coolant getting past the

is displacing the lubricant. A better lubrication system was designed and has stopped most of this trouble.

Preventive inspections find these trouble spots before much damage has been done.

Reduction of stock and spare inventories is another long-range objective of the plan. After a preventive maintenance program in an area has progressed to the point where regular inspections, replacement of wear parts and overhauls are scheduled, spares can be requisitioned just before the scheduled replacement or overhaul. This minimizes inventories. In addition to the lowered investment a tax saving is also secured.

One of the most important results of the system from a production viewpoint is the improvement in quality and increase of quantity of the product. Well maintained machines and equipment not only increase production because of fewer unscheduled down times but also produce higher quality products

with less scrap. The basis for any good quality control program is the condition of the tools and equipment. When quality control charts are out of control, it is an indication that something is wrong with tools or machinery.

In one area of the company on high precision production boring equipment, Fig. 4, when the quality control charts indicate trouble, the spindles are all checked with indicators. Through this inspection it is determined whether the bushings and bearings are in need of attention. These inspections

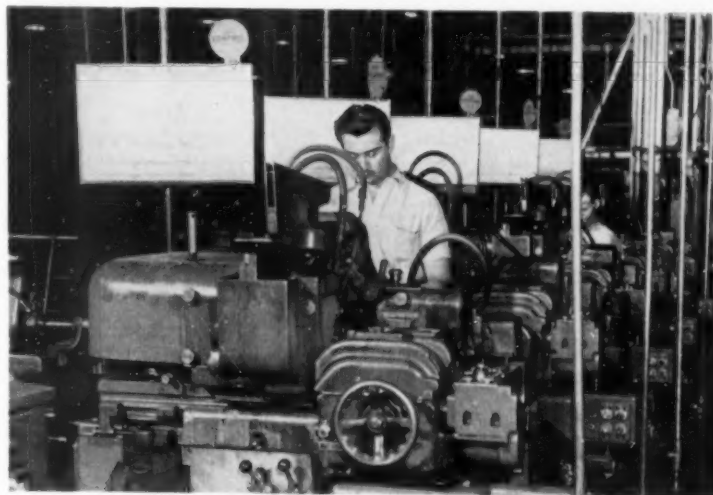


Fig. 4. (right) Preventive maintenance operated in conjunction with quality control has effected savings by machine inspections before scrap is produced.

Fig. 5. (below) Three basic forms of preventive maintenance program: (Back) machinery and equipment repair record; (left) maintenance request; (right) maintenance craft job card.

Form 1400
Rev. 1-1-52
Tag No. 261305
Department 6950

Ford Motor Company

MACHINERY AND EQUIPMENT REPAIR RECORD

Location A-48 Machine Name Chip Drag

DATE	NATURE OF REPAIRS MADE	MATERIAL COST	TOTAL REPAIR HOURS	CRAFT HOURS REQUIRED									
				ELECT.	MILL.	WELD.	HYD.	PIPE	MACH. RPR.	FLOR.	SHOP	OTHER	
5-15-53	Repaired chain, side links, shaft and sprockets		8		8								
5-19-53	Repair shaft sprocket.		8		8								
5-20-53	Repair chain.		8		8								
5-26-53	Repair chain.		8		8								
6-1-53	Repair chain.		8		8								
6-5-53	Repair chain and slide plates, broken drive shaft												
6-6-53	Shaft & sprocket - Mill keyway, repair chip drag												

FORM 650
REV. 1-1-52

**FORD MOTOR COMPANY
MAINTENANCE REQUEST**

DATE 6-5-53 DEPT. No. 6950 BAY A-48
TAG No. BT 261305

TYPE OF MACHINE Chip Drag

REPAIRMAN WANTED ☐ MACH. REPAIR ☐ TIME REQUESTED 7:00 AM

☐ ELECTRICIAN ☐ HYDRAULIC ☐ TIME STARTED 7:30 AM

☒ MILLWRIGHT ☐ PIPEMAN ☐ TIME COMPLETED 11:30 AM

☐ WELDER REPAIR ☐ OTHER

SIGNATURE OF FOREMAN Steve Mitter

FORM 635
1-1-52

**FORD MOTOR COMPANY
MAINTENANCE CRAFT JOB CARD**

Craft Millwright Badge 6-4820 Dept. 6977 Date 6-5-53

HRS TAG NO. TYPE OF EQUIPMENT BAY DEPT. ACCT. FORT.

4 261305 Chip Drag A-48 6950 8 M.

4 76667 Repair Broken shaft-Drive

JEFFERY CRUSHER A-50 6941 88

WHAT AND WHEN TO INSPECT		INSPECTION FREQUENCY					
		Daily	Weekly	Semi-Monthly	Monthly	Semi-Annually	Annually
DRILL PRESS							
Electrical			X				
Lubrication		X					
Bearings				X			
Feed				X			
Gear Box				X			
PUNCH PRESS							
Lubrication		X					
Electrical			X				
Mechanical				X			
GRINDER							
Electrical			X				
Lubrication		X					
Bearings				X			
Ways and Gibs				X			
AUTOMATIC SCREW MACHINE							
Bearings				X			
Cams				X			
Spindles				X			
Electrical				X			
Lubrication		X					
MILLARDE							
Electrical System			X				
Lubrication		X					
Cutting Liquid		X					
Fixtures			X				
Table			X				
Slide			X				
Bearings			X				
Case			X				
Bracket Assembly				X			
CLEANING							
Electrical		X					
Lubrication		X					
Hydraulic			X				
Bearings			X				
Index		X					

Fig. 6. Typical inspection schedule form.

are made during normal down time such as rest or lunch periods, nights and week ends. The alternate to this program would be to run the equipment till quality control charts are out of control, then shut down the equipment for repairs or overhaul because of excessive scrap.

Improper use of tools can also cause excessive maintenance along with poor quality. An example of this is the use of dull drills. After they become worn, there is more of a punching process than a drilling. As a result, excessive bushing replacements are required. The extra maintenance is in addition to excessive tool losses.

Procedure Used

The cornerstone of any preventing maintenance program is accumulation of authentic historical data. This is used to develop the various schedules of inspections, replacements and overhauls. Recording the necessary data is accomplished by use of forms described in a detailed procedure which appears in the plant engineering maintenance standards manual. The manual is widely distributed to production supervision.

One of the basic forms is the machinery and equipment repair form, Fig. 5. An entry is made on this form for each repair along with material costs, repair hours, and craft notation. This information is posted from the maintenance craft job card, Fig. 5 (inset right), which is a daily record

of each maintenance worker's jobs. It contains a description of each repair, the hours required and the department to which it is charged. The production foreman concerned signs for each repair in his area to indicate his approval of the maintenance service. The job card enables management to identify idle and travel time as well as emergency work resulting from poor planning or failure to report conditions of a machine needing attention.

The maintenance request form, shown in Fig. 5 (inset left), acts as a purchase order from the production foreman. It shows the craft repairman needed and when the equipment will be available. After processing, it is kept by the production foreman as his permanent record of maintenance services. Data assembled on the repair record card can also be used as an aid in establishing parts replacement cycles, in developing inspection check sheets and in scheduling inspections.

Though some of these are long range objectives, much of the data can be put to use immediately. Repetitive repairs, faulty design, production malpractice, obsolescence and working equipment beyond capacity are typical examples of what can be determined by analysis of the form. Detailed support will also be available to document budget requirements. Eventually, it may provide data to aid in establishing nonproductive labor work standards. For example, in one area, faulty design in a spiral chute was recognized through examination of the record card and was corrected by replacing a steel impeller with one of rubber, thereby reducing wear and resulting in a projected yearly maintenance saving of \$3800. In another instance, through analysis, it was found that excessive repairs were being made on a production grinding machine. Change in design resulted in a projected cost saving of \$700 per year.

Collected data may also suggest replacement of obsolete equipment. For instance, from a repair record card, it was discovered that the projected annual cost of repair and scrap on a lathe was \$29,500. The original cost of the lathe was \$6,000 while current replacement was estimated at \$16,000. In one division repairs on an old vertical lathe, projected for a year, were approximately \$12,000, while the cost of a new machine was about \$8,500. These examples show the value of historical records.

The next phase in extending the program to a new area is the establishment of various schedules, such as inspection, lubrication and parts replacement. The inspection plan is to detect defects and report when renewals and replacements should be made. Systematic inspections focus attention on certain parts of equipment for specific signs of trouble. Inspection forms are designed to indicate to the inspector what to look at and what to look for.

The three initial steps in the inspection program are: (1) separate all equipment in general classifications; (2) list items to be inspected on each piece of equipment; (3) determine what to look for on each item. The basis for timing inspections is to space them as far apart as possible to reduce cost, yet stay within safe limits of time during which defects ordinarily do not develop to the point of emergencies. The most economical inspection frequency is determined by trial and experience which is then set up as a schedule.

Thus, time schedules for inspection vary considerably, depending on kind of equipment, and conditions under which it operates. Experience of area plant maintenance men is utilized in setting up the plan for each plant. Part of such a schedule is shown in Fig. 6. Inspection forms are designed to meet the needs of the particular division of department concerned and are as general, or specialized as circumstances or requirements dictate, thereby providing almost unlimited coverage, Fig. 7. Ample

space is allowed for a number of machines or equipment on the more general forms and a remarks column is also provided to note the repair needed.

In a specialized operation, such as a press plant, more detailed inspection forms are used, Fig. 7 (left). Thus, a separate form may be used for each type of inspection and for each machine. This permits a more detailed breakdown insuring a more complete inspection where necessary.

A third type of inspection form is used in smaller plants or areas containing a minimum amount of equipment, Fig. 7 (right). These inspection forms vary from others in that one card lists chronologically several inspections of the same equipment. Inspections cycle dates entered act as a record of inspections made and in some types of file systems actually maintain schedules so that little clerical work is required to coordinate future schedules.

As important as the inspection itself, is the follow-up, to correct the trouble discovered by inspections. This is done by means of a form letter which suggests that a maintenance request be issued to cover the necessary repair services. A review of the machinery and equipment record card, Fig. 5 is

Fig. 7. Sample inspection forms: (back) general form; (right) form developed for smaller plants; (left), specialized type form for large equipment.

**MACHINE REPAIR MAINTENANCE INSPECTION
CHECK-OFF SHEET**

PLANT <u>778</u> DEPT NO. <u>6977</u>																DESCRIPTION OF REPAIRS NEEDED		
AREA _____ SECTION _____				BEARINGS	SHAFTS	SHIELDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS		STANDS	STANDS
DATE INSPECTED _____ INSPECTED BY <u>2-3452</u>																		
TAG NO.	NAME	LOC.	FREQ.	BEARINGS	SHAFTS	SHIELDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS	STANDS
261206	12" Chip Drag Conveyor #2	348	Weekly	X	X	X	X	X	X	X	X	X	X	X	X	X	X	New Pins
				X	X	X	X	X	X	X	X	X	X	X	X	X	X	New take-up bearings
				X	X	X	X	X	X	X	X	X	X	X	X	X	X	Installed new rollers
				X	X	X	X	X	X	X	X	X	X	X	X	X	X	Installed new pins, shafts

ELECTRICAL INSPECTION REPORT

INSPECTOR 28570N BLISS

TYPE PRESS 28570N BLISS

DATE 5-5648

DEPT 6890

MASTER STATION PANEL	OK	BRAKE PRESSURE SWITCH	OK
PILOT GLASS	OK	CONTACTS	OK
PILOT LIGHT	OK	REGULATOR	OK
INCH BUTTON	OK	WIRING	OK
MAIN MOTOR BUTTONS	OK	ROTARY LIMIT SWITCH	OK
FORWARD BUTTON-FAST	OK	RINGS	OK
FORWARD BUTTON-SLOW	OK	RING SCREWS	OK
REVERSE BUTTON	OK	CONTACT ARMS	OK
STOP BUTTON	OK	CONTACT SPRINGS	OK
KEY LOCK	OK	CONTACT CONNECT	OK
CONTROL PANEL	OK	CONTACTS	OK
CR. RELAY CONTACTS	OK	SPROCKET	OK
CR. RELAY COILS	OK	SET SCREWS	OK
MOTOR RELAY CONTACTS	OK	KEYS	OK
MOTOR RELAY COILS	OK	DRIVE CHAIN	OK
OVERLOAD RELAYS	OK	BED MOTOR	OK
DISCONNECT SWITCH	OK	UP LIMIT SW	OK
440 V TO 110 V TRANS.	OK	DOWN LIMIT	OK
PALM BUTTONS	OK	FLEXIBLE	OK
STANDS	OK	BED MOTOR	OK
CORDS	OK	UP BUTTON	OK
PLUGS	OK	DOWN BUT	OK
LOCKS	OK	KEY LOCK	OK
FOOT BUTTONS	OK	SELECTOR	OK
CORDS	OK	SELECTOR CONTACTS	OK
MOUNTINGS	OK	MISCELLANEOUS	OK
PRESS RECEPTACLES	OK		OK

FORD MOTOR CO. INSPECTION CHECK-OFF RECORD

PLANT Engine DEPT 1052

AREA Tool Room SECTION 1A

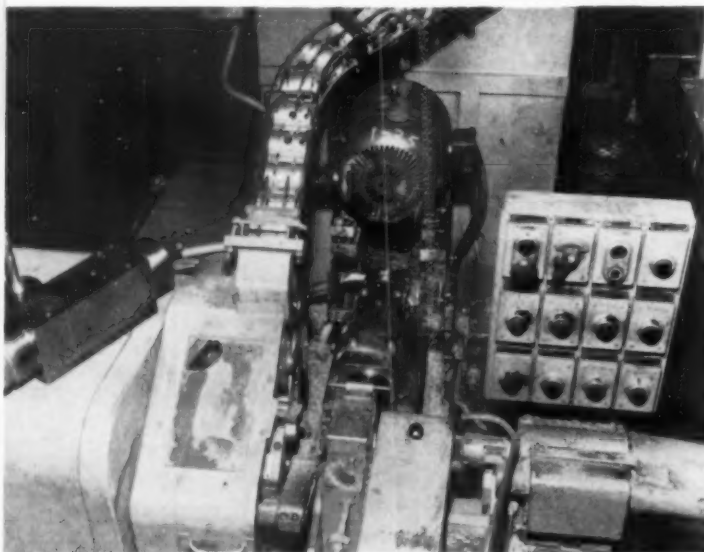
MACHINE OR EQUIPMENT TAGS	INSPECTION INTERVALS							
	1-3-54	2-1-54	3-1-54	4-1-54	5-1-54	6-1-54	7-1-54	8-1-54
Lathe 107561	V	V						
Grinder 107562	V	V						
Shaper 107563	V	V						

also made later to insure that corrective action has been taken.

Pieces of equipment where inspections have disclosed needed repair work are flagged with a metal tab indicating that the equipment is in need of repair. The tag remains until the completed repair is posted from the maintenance craft job card.

Another essential part of the preventive maintenance program is the lubrication schedule. The necessity for such a program is indicated by the estimate that 85 percent of machine breakdowns are caused by faulty lubrication. Lubrication schedules are organized by departments and list locations, type of lubrication system components, code numbers of lubricants to be applied and frequency of application. These records provide a basis for adequate scheduling and uncover areas in which lubrication equipment is in disrepair, missing or failing to function altogether. The lubricator's

Fig. 8. Spindle replacement is performed during normal scheduled down time. Experience has determined the expected life of the part so replacement can be made before breakdown occurs.



machinery report lists items needing attention. The reverse side of the form is used to follow up on needed lubrication system repairs.

After lubricant needs and frequency cycles for each machine or group of machines are established, actual scheduling or routing is developed. This is handled in several ways. Perhaps the simplest is that in which frequency of lubrication application is limited and can be combined with inspection cycles. In this manner, a minimum number of routings are developed for each oiler. Current plant layouts are used to establish the most efficient route with consideration given to high-speed or critical machines in each area. To insure complete understanding and compliance, copies of layouts with

routings marked are made available to the oiler.

Another method uses a tickler file for each cycle on each piece of equipment. The file is in chronological sequence, permitting a listing of the work load to be made for any particular day or week. After the work is finished each card is returned to the tickler and filed for future cycles.

A third method is adaptable to areas where there is a large grouping of machines and equipment. This makes use of a machine-record system. From a record card of the lubricants needs of each machine a record plate is made for each separate lubricant application cycle. The equipment tag number, location, name, amount of lubrication used, lubricant cycle, lubricant code and general instructions are listed. Plates are coded as to cycle frequency and may be run off for any particular period. Instruction cards are given to the oiler assigned to a particular area.

This method may also be used with other maintenance inspections to insure a rigid control over all machine and equipment inspection. It facilitates the long range objective of the preventive maintenance program of replacement of major units of machinery and equipment prior to the end of their life expectancy, *Fig. 8.*

Conclusion

While the value of scheduling periodic inspections has long been appreciated, it is seldom fully utilized. In one plant at the Rouge, within a week after introduction of the maintenance inspection program, enough savings were made to pay for the complete program for several weeks of operation.

A good preventive maintenance program requires constant attention in order to make adjustments for changes in plant and production. It is essential that there be close cooperation between supervisor and personnel of production and maintenance as well as with plant engineering and tool design departments. A good portion of the responsibility for the effectiveness of the program rests directly with the production supervisor. It is his duty to report to the maintenance foreman any equipment requiring service before failure occurs. Production personnel often knows when equipment is headed for trouble. Many times a piece of equipment that breaks down on Monday or Tuesday was failing when the machine was shut down the previous Friday. When production people are completely sold on the program they can report to the maintenance foreman, repairs can be made during the scheduled down time, and the production loss avoided.

Production personnel merely needs to witness a dramatic instance of results of the program to be convinced that a preventive maintenance program can pay dividends.

Releasing Magnet

For handling and transferring small steel parts such as screws, nuts, washers and clips, a magnetic holder is very useful. In most cases it is superior to mechanical fingers in that its function is not affected by variations in size and shape of the product handled.

Magnetic holders are of two distinct types, permanent and electromagnet type. The permanent type has the disadvantage of being nonreleasing. The part held must be removed by a force greater than that of the magnet. This is not always practicable in some machines.

The electromagnet, on the other hand, is inherently more easily damaged. The strong magnetic field present in some applications, such as projection welding machines, may cause undesired currents in the coil and subsequent failure.

The holder shown was designed to possess the advantages of both types without the serious drawbacks of either.

At the left are shown views of the holder in the "hold" position. The permanent magnet is a stock type of Alnico or similar sintered or cast material. All parts, except the magnet and pole shoes, are of nonmagnetic material such as brass, bronze, aluminum or austenitic stainless steel. The magnet is a slip fit in the body. On the bottom of the body is silver soldered a circular plate, which contains two segment-shaped pole shoes. These pole shoes, of mild steel or wrought iron, are shaped and located to match the forked end of the magnet. The cover, attached to the body by brass screws, (not shown) holds the magnet in place but allows it to be rotated. A shaft, securely fastened to the magnet, and a lever, provide the rotating mechanism. The magnet may be rotated through 90 degrees. An ordinary hexagon nut is shown held in place by the holder.

As may be seen in section A-A, the pole shoes in the "hold" position form a continuation of the poles of the magnet and the magnetic circuit, indicated by the arrows, is closed through the nut, holding it in place.

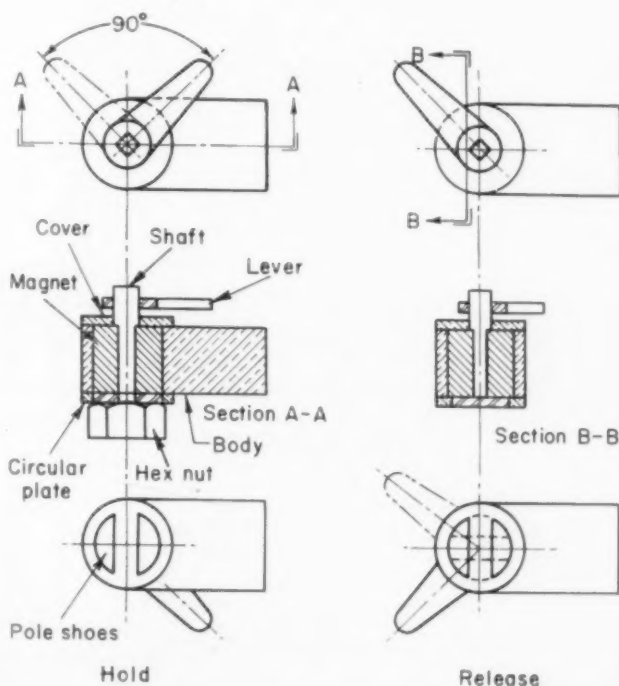
A quarter turn of the lever brings it and the magnet into the position shown in the right-hand views. Then, as may be seen in the lower view, the pole shoes are no longer a continuation of the

magnet poles, but bridge the poles and short out the magnetic circuit. The circuit is completed through the pole shoes as indicated by the arrow, section B-B. A slight departure from true projection is used to illustrate the magnetic circuit.

It is essential that the thickness T , in section A-A, be great enough to accommodate the magnetic flux when the holder is in the "release" position, otherwise, the pole shoes will reach magnetic saturation and the leakage flux will not allow the nut to fall freely.

The mechanism shown may be adapted to almost any type of machine. The body may be extended radially from the center of a turret or may be a slide. In the latter case, if made from a good bearing bronze, it may be operated in steel ways. The arm may be operated by a cam or link mechanism, or may be replaced by a rack and pinion.

*Merle L. Deckard
Detroit Chapter*



Cam Milling Fixture

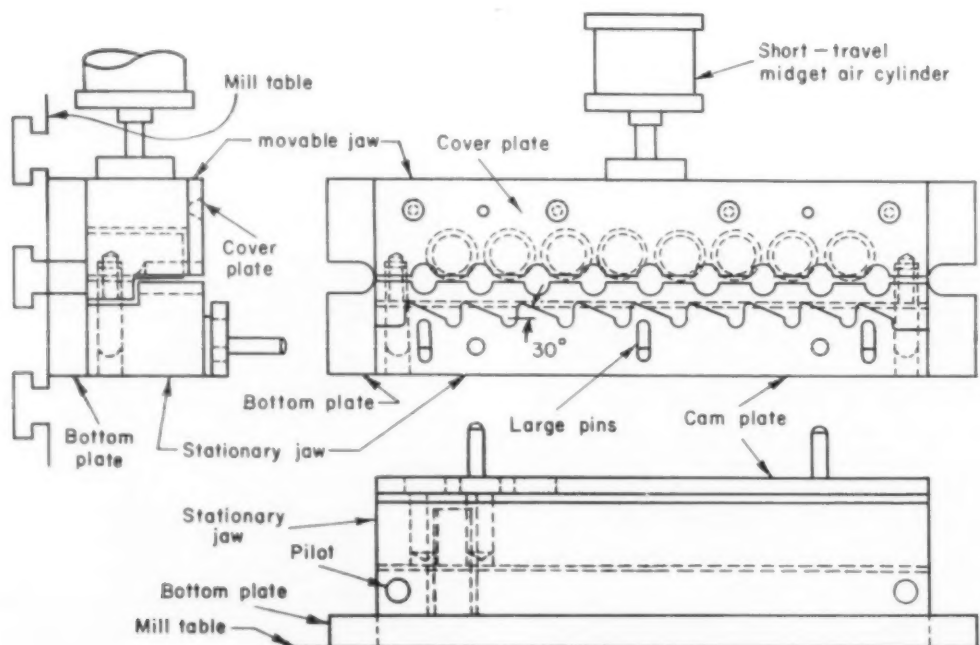
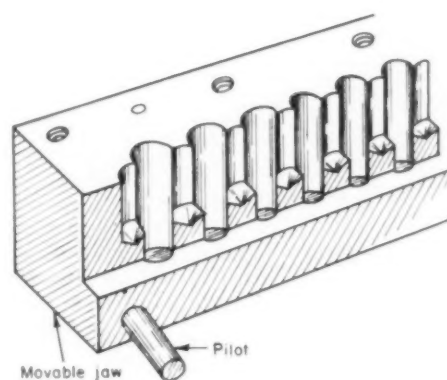
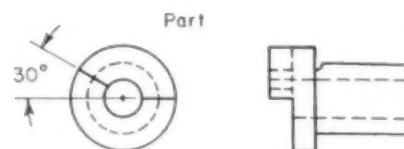
A fixture was needed to mill a 30-degree cam surface on the head of a special bushing. Milling the first pass to remove half of the head was simple, but rotating the work so the second pass would produce the 30-degree cam was more complicated. The tooling shown was designed to solve the problem and has proved itself in production.

The fixture consists of a bottom plate, a stationary clamp jaw and a movable jaw. Semicircular spaces are provided in the faces of the jaws to accommodate the body of the bushing. Clamping action is provided by large pins in holes in the movable jaw. They are retained in place by the bottom plate and a cover plate which fits closely enough to keep out chips but not closely enough to interfere with clamping or locating.

After the work is loaded, the first pass mills half the cam. Then the table is returned to starting position. The clamp is relaxed and a cam plate is forced manually against the milled surface of the work, causing it to rotate the required 30 degrees. The fixture is then reclamped and the second pass is made. The cam plate is kept square by keys working in slots, and is held to the stationary jaw by screws through the keys (not shown). The two jaws are kept aligned by pilot pins, as shown.

Excellent production has been realized from this fixture by arranging for one operator to run two milling machines at once.

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Saginaw Valley Chapter*

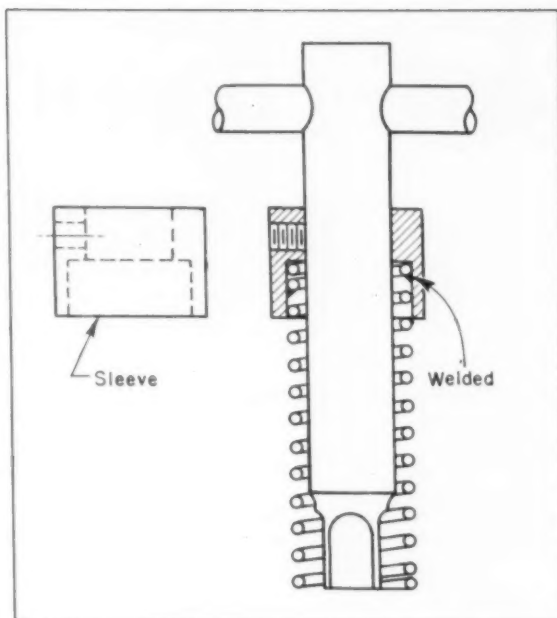


Safety Chuck Wrench

A chuck wrench is a hazard if left in a chuck accidentally. After a number of accidents in the shop, all chuck wrenches were altered in the manner shown in the accompanying sketch to eliminate this danger.

A spring fastened to a collar is attached to the shank of the wrench by a setscrew so that the spring must be compressed for the wrench to engage the chuck. For best results the collar is adjusted so that the spring is approximately flush with the bottom of the chuck wrench. A light spring is used so the operator can easily manipulate the wrench with one hand. When he removes the pressure, the wrench is ejected from the chuck and cannot be left in place.

*L. E. Doyle
Chicago Chapter*



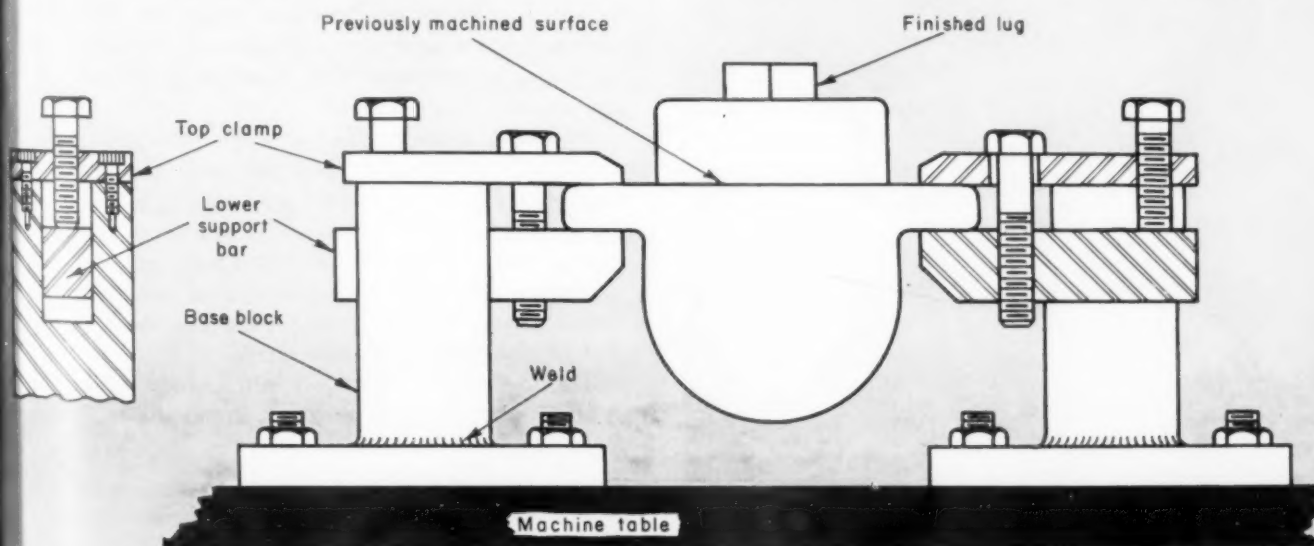
Inverted Milling Machine Fixture

Often a machining job similar to the one illustrated is encountered. In this particular case a semi-round casting had to be mounted on a milling machine for machining a lug on the top surface. The lug must be square to and parallel with a previously machined flange. The flange is, unfortunately, also on the upper rather than the lower side. For this reason, conventional blocking methods cannot be used to support the work. A single-purpose fixture would be too expensive for the limited quantity of pieces required so this general purpose upside-down clamping and supporting system was devised. The

support blocks and clamp bars are easily made and may be used for many jobs of a similar nature. Loading and unloading is done as rapidly as with conventional fixtures and great rigidity is possible if the device is made of heavy stock.

The top clamp is fastened to the base block with screws after the slot or opening was milled to contain the freely positioning lower support bar. Action of the two adjusting bolts is evident from the sketch.

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Member at large
Stillwater, Okla.*



Milling Original Contoured Shapes

with interpolating tracer control

By Frank W. Hale

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AIRFOIL SHAPES are commonly described by a series of spaced cross sections on drawings. The manufacture of prototype shapes has long been a bottleneck in the development and production of original masters. Usual production methods require weeks of calculation and result in shapes that have to be faired by hand between the specified cross sections. Such hand blending operations preclude

uniformity of product and demand skilled craftsmen. The finished product can only be inspected for conformity at the designated cross sections.

To ease this situation, The New England Machine and Tool Co., Berlin, Conn., has developed a machine, distributed and serviced by Pratt & Whitney, to produce prototype airfoil shapes, *Fig. 1*. Under development for six years, the machine, called the Model 102 Airfoil Electronic Milling Machine, produces a completely machined airfoil master in a few hours using information currently found on drawings. Hand fairing is not required.

Two completely new developments—a noncontacting tracer control and a fair-curve interpolating system—are combined in a new system for milling original airfoil shapes from a series of simple templates. With a simple setup of the actual size templates of the specified cross sections, this machine, *Fig. 2*, mills the complete blade in one operation. It automatically interpolates airfoil shape between sections and extrapolates the shape beyond sections even though the specified contours differ markedly in shape and relative orientation. The master shapes are usually cut from rectangular or cylindrical stock.

A template, *Fig. 3*, is made for each of the cross sections specified on the airfoil drawing. These are spaced on an arbor and lined up so chordal tangents or other easily set up lines are all parallel. Also shown, are a typical airfoil section and a drawing indicating the actual angular relationships between the specified cross sections.

Operation of the machine is simple. The milling cutter, *Fig. 4*, moves toward and away from the workpiece axis to generate the shape during rotation of the work, and the carriage moves slowly and continuously parallel to the workpiece axis. A complete airfoil section is generated in one longitudinal pass of the cutter, although several roughing and finishing cuts are usually made.

The machine has a headstock in the middle, and a tailstock and carriage at each end. A variable-speed

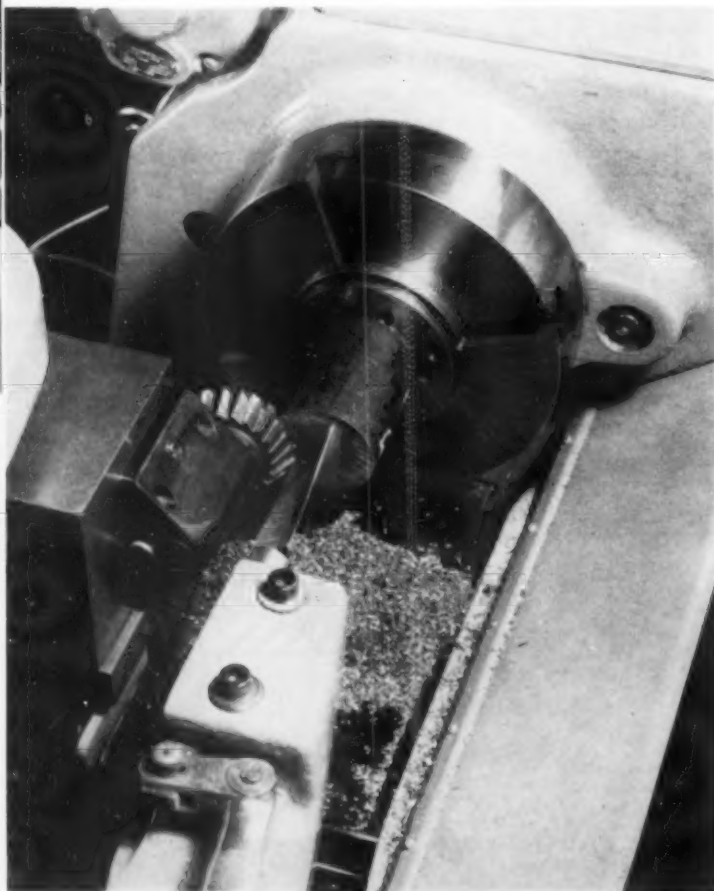


Fig. 1. Interpolating tracer controlled milling cutter generates original airfoil master from cylindrical bar stock in specially developed machine.

motor in the headstock drives the work spindle through a two-step pulley to give two speed ranges. A powerstat provides automatic speed control of the work spindle. Through a differential gear train, the same motor rotates the template arbor. The work spindle carries a T-slot faceplate, *Fig. 2*, on which one end of the workpiece is fastened. The workpiece is supported at its other end by a tailstock.

The milling head is mounted on a cross slide on the carriage at the workpiece end of the machine. The cross slide is driven through two magnetic clutches. The other end of the machine comprises the control for cutter motion normal to the workpiece axis. The control end of the headstock carries the template spindle with its collet chuck. The other end of the template arbor is supported by a tailstock.

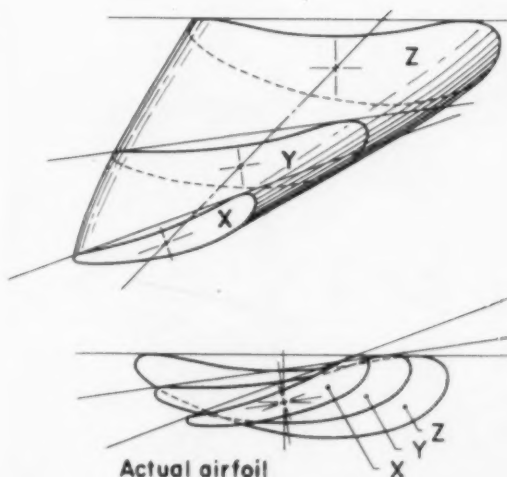
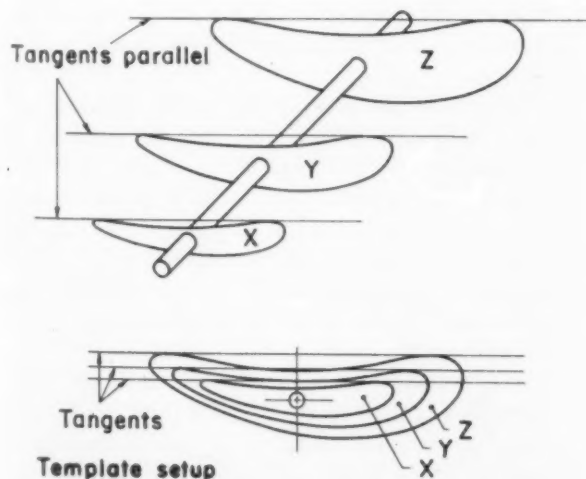
For the generation of complete airfoils from a series of cross-sectional templates, the carriage on the control end is stationary. Supported on top of this carriage are a number of reciprocating template follower bars, *Figs. 4 and 5*. Template followers are mounted on one end of these bars. The other ends are formed as knife edges and magnetized to hold a thin flexure member that contacts all knife edges and serves as a continuously varying model to guide a noncontacting tracer. Commercial precision feeler stock is used as the flexible member. The followers are held in contact with the templates by light tension springs.

Fig. 2 (right) Airfoil generating machine has a headstock in the middle as well as a tailstock and carriage at each end. This view of the workpiece end shows the T-slot faceplate that holds the workpiece.

Fig. 3. (below) Templates for the specified cross sections are placed on an arbor, left, with their tangents parallel, in spite of the actual angular relationships, right.

The milling cross slide and the noncontacting tracer point are mechanically linked and move as one unit. A manual adjustment provides for adjustment of the tracer relative to the milling slide. After taking roughing cuts, this is used to adjust for a finish cut.

The faired surface of the generated contour is obtained as the resultant of two separate processes: (1) interpolation of cross sectional shape between templates by means of a moving member acting as though it represented successive fairing elements of an imaginary master blade having the correct cross section contours but lacking twist and (2) introduction of the desired twist by a programmed rotation of the guiding templates relative to the



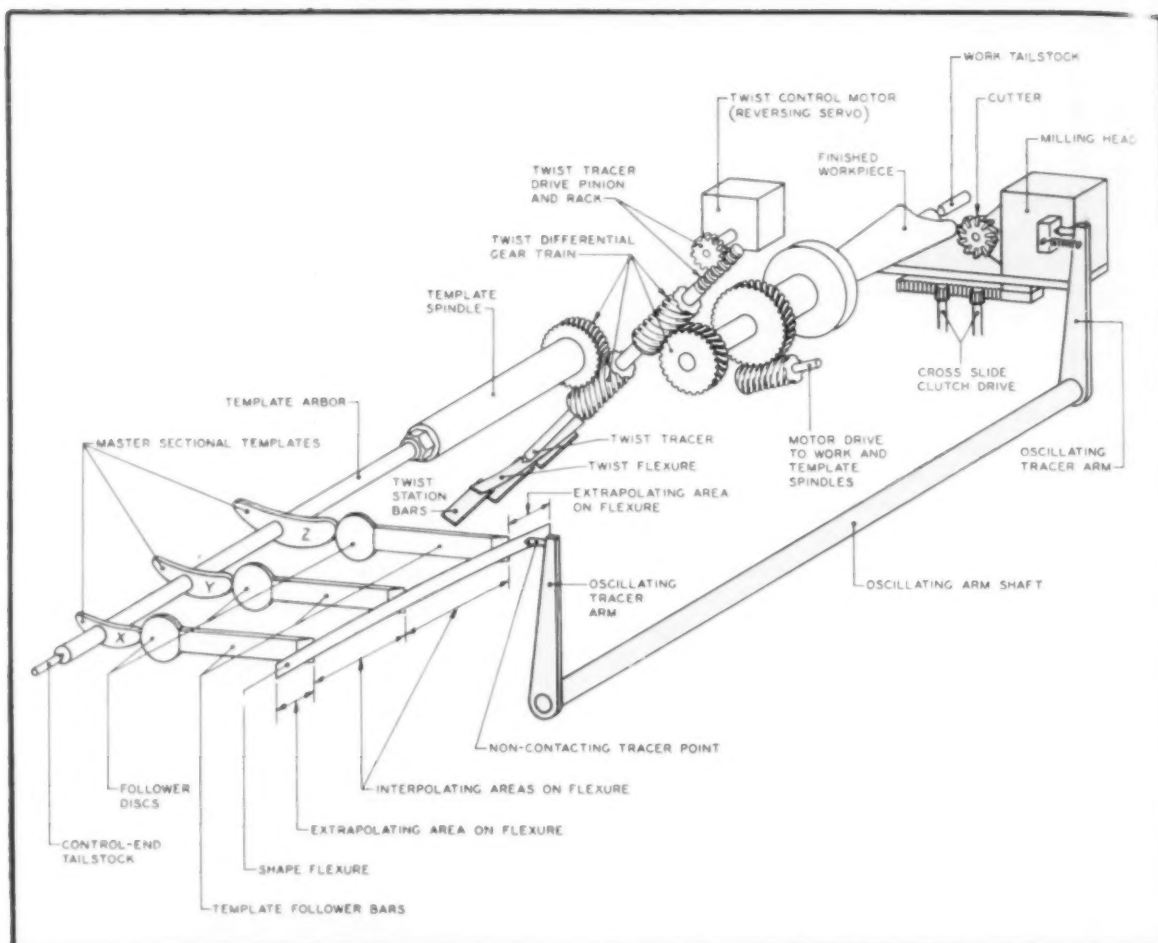
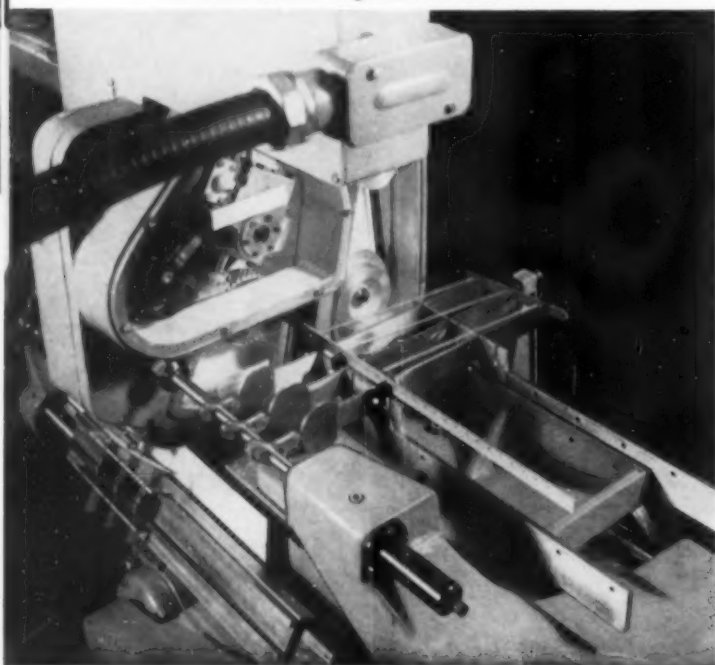


Fig. 4. Diagram of the control elements shows both shape and twist control units. Tracer points do not contact flexure members. Members in color, move longitudinally as a unit.

Fig. 5. Twist tracer control elements are shown on the inclined carriage at the left.



instantaneous work position. These two processes operate concurrently but can best be described as separate functions.

The machine is arranged so that each template drives the corresponding sliding bar in the exact motion required to mill the desired shape at the corresponding cross section of the workpiece. All instantaneous positions of the flexure member represent the respective required positions of the milling cutter at all points between the specified cross sections.

For the flexure member to correctly represent fair elements joining similar points on all templates, it is necessary that the templates be aligned with little angular displacement between their respective features of similarity. This requirement creates the need for the second function of the interpolation process—introduction of the desired angular displacement between specified cross sections in the workpiece.

The desired twist is introduced into the work through a differential gear train that rotates the stack of templates relative to the instantaneous position of the work. The differential is under the control of a second interpolating system, Fig. 5.

The twist interpolating system consists of a set of bars with magnetized knife-edged ends. These bars are mounted, at spacing intervals to correspond with the templates, in a carriage that moves longitudinally with the cutter head carriage. The knife edges are set to project a distance from a reference shoulder proportionate to the twist desired at each specified station. A flexible member (feeler stock) lying across the knife edges provides a smooth curve representing twist at all positions. Through the action of a second noncontacting follower, the twist differential gear train is operated in proportion to the height of this curve as the carriage passes by.

The noncontacting tracer systems used in this machine are unconventional but simple electronic controls. These systems operate to maintain a certain length spark gap between the flexible member and the tracer point, and thus accurately control the cutter position. A high voltage, low amperage current is applied to the tracer point, and, as the tracer point approaches the grounded, electrically conductive flexure member, a spark will jump. The voltage established across the gap is utilized in the electronic control circuit as a measure of the gap. Also, electronic anticipation circuits measure the rate of minute changes in this gap. Variations in the gap length control the relative magnetic flux in a pair of electromagnetic clutches which in turn drive the cutter cross slide so as to minimize the spark variation. In normal operation, both clutches are always driving and slipping, the relative amounts of energization determining direction of movements.

In the cutter cross-slide control, the output of the electronic control circuit consists of two channels of direct current that vary inversely with each other in magnitude as the spark length varies, becoming equal at a spark length of about 0.001 inch. These output currents determine the flux in the oppositely driving magnetic clutches that are geared through independent trains to the cross slide. With this smooth but "stiff" tracer control, even under heavy cutter loads, variations in the spark length are much less than the best milling tolerances and accurate workpieces are produced.

In the twist tracer control, load and speed requirements are in a range low enough to permit use of a reversing, two-phase, low-inertia, servomotor, *Fig. 6*, instead of magnetic clutches. For this application, the spark-gap voltage between the twist station flexible member and the tracer point is used in a circuit that reverses the phase of the twist motor. The twist motor then functions to move the twist tracer shaft axially, and, through the differential, imparts the required rotation to the template arbor relative to the instantaneous position of the workpiece.

The complete electronic circuits for the machine are mounted on a small plug-in chassis that can be

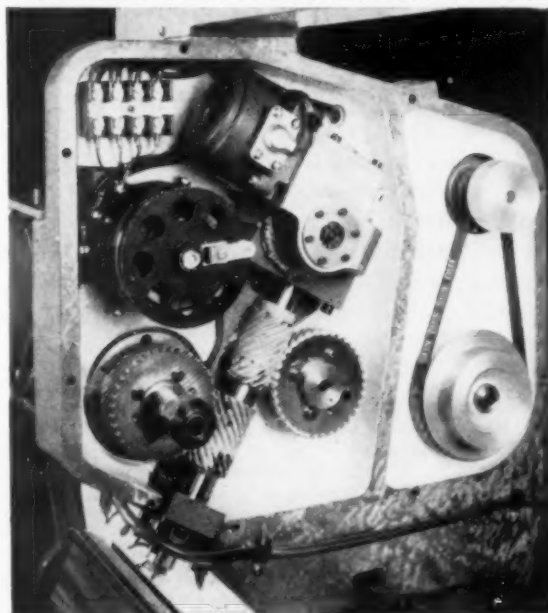
removed in the event of trouble for instant substitution of a complete spare chassis. All tubes are standard radio and television types.

When it is desired to make small quantities of duplicate shapes for experimental purposes, instead of using templates, the machine employs a complete master airfoil shape, in which case the machine will duplicate the shape. When the machine is copying from a complete airfoil, the control-end carriage is tied to the motion of the milling head carriage and moves with it over the slow continuous feed parallel to the work axis.

Also, only one sliding knife-edged template bar is required on top of the carriage. The noncontacting point, or spark gap, is situated on the circumference of the follower roll rather than on a flexible member at the knife-edge end of the bar. This direct copying feature is especially useful in experimental shops that must produce small quantities of many different airfoil shapes. Because the tracer can climb steep surfaces, both the airfoil and its cylindrical or conical platform can be milled from solid bar stock in one operation.

The cross-sectional templates used in the machine can be produced by standard toolmaking procedures. In order, however, to provide an accurate and rapid method for producing such two-dimensional shapes, The New England Machine and Tool Co. has developed another machine to do this task. This machine uses an electronic noncontacting tracer that works directly from enlarged drawings. The drawings are made with silver ink. An adjustable sine-bar reduction mechanism is provided for reproducing templates or cams at ratios of 1:1, 2:1, 5:1 and up to ∞ :1, from the drawing size. Accurate templates can thus be produced in a minimum of time. The reduction feature amplifies the accuracy of the product.

Fig. 6. Control side of the headstock contains the twist-control motor at the top, the work-spindle speed-control powerstat and the differential gear train. The template arbor is held in the collet chuck at the left.



DESIGNED FOR

MACHINES • TOOLS • PROCESSES • METHODS

FUSE HEAD TOOLING

built up of standard units

By **F. G. Gepfert**
President

Black Drill Co., Inc.
Cleveland, Ohio

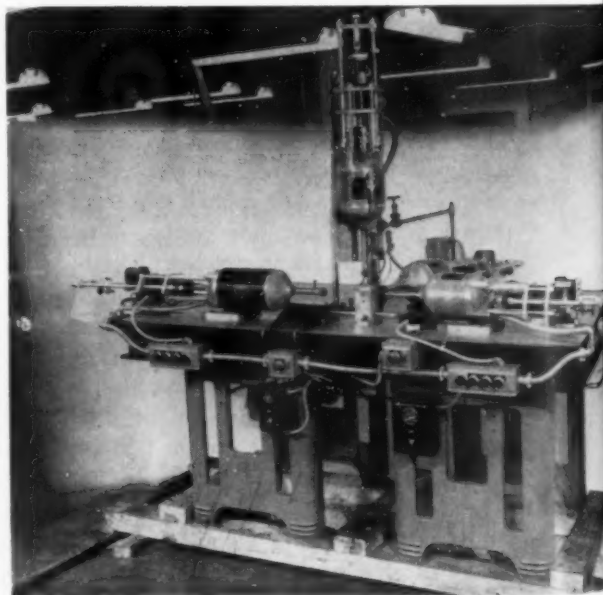
Advantages of standard packaged power units and other standard items are well-illustrated by two new machines used to ream and tap holes in artillery shell fuse heads. Modification of arrangement and addition of fixtures can convert either machine to other uses, or they can be completely torn down so components can be used in other machines. One machine reams multidiameter holes and the other taps threads in the holes.

Workpieces are die castings described as truncated ovoid forms with circular stems. At each end of the axis a rough multidiameter hole is cast. Radially about the ovoid are two other holes, both having several diameters. One hole is at right angles to the line of tangency, the other is at right angles to the axis. All holes meet in the center. They must be reamed to size and opened into the center. In a subsequent operation each hole is tapped, three with right-hand and one with left-hand threads. The minimum effective threads in one hole is so short that the maximum thread length is 0.070 inch at 24 threads per inch. All holes are cast ± 0.004 inch from a nominal dimension established at 0.004 inch larger than finished diameter.

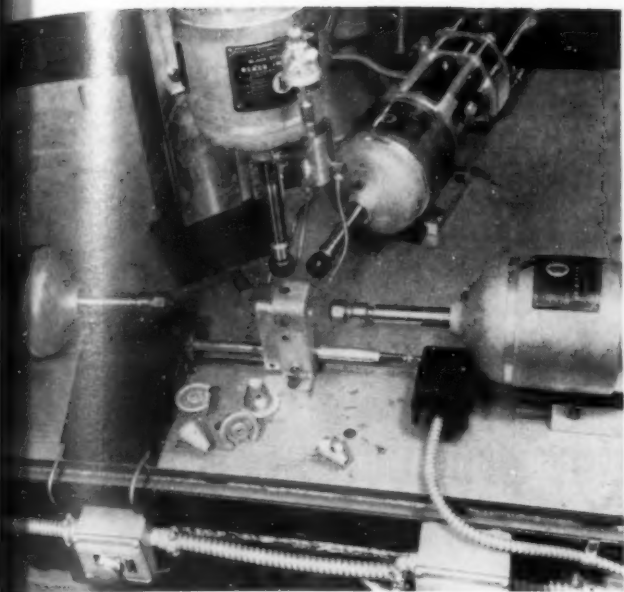
Developed for this job were one machine for reaming and one for tapping. Many of the components of these machines are identical. Each con-

sists of a machine base of box-type welded construction that also serves as the coolant reservoir. A straight keyway, machined the length of the reaming machine table, serves as a locating line for the axis-reaming units and the work-holding fixture. The workpiece is positioned in the fixture by means of a shoulder and pin locator on the casting. An air cylinder clamping device positively locks the workpiece in the fixture. Black-In-Line Drilling Units are used for power. The axis-reaming units are mounted on keys and then doweled in position. The unit that reams at right angles to the tangent line is located on a key on the table top. The fourth unit is supported vertically above the axis of the piece.

With the clamp in the open position, the operator hand loads the workpiece. The operator then depresses a cycling button that operates a four-way solenoid air valve to actuate the air cylinder and



REAMING MACHINE used on multidiameter holes in a fuse head is built up of four standard drilling units and other standard parts. It can be modified for use on other workpieces or disassembled so components could be used in building a machine for an entirely different operation.



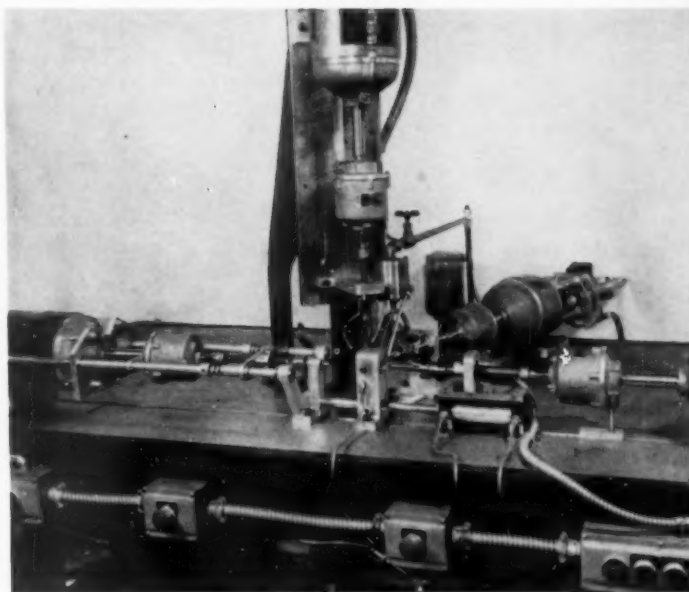
REAMING MACHINE major components include four drilling units, a workholder and an air cylinder to clamp the workpiece. Several workpieces are shown in front of the workholder. Air cylinder piston ram extends through the clamp to actuate a switch that starts the drilling units. Tooling is not shown.

lock the workpiece. At the same time, an extension of the piston ram contacts a precision limit switch through the fixture. Closing of the switch energizes solenoids on all four drilling units, which start in a forward working cycle.

The two axis reaming units and the unit reaming at right angles to the axis are so cycled that their operation is completed and the units withdrawn before the fourth unit enters the work. This unit reams past the centerline of the part and thus makes the internal connection between all the holes. The tooling is all subland multiple-diameter carbide step-reamers.

At the end of the fourth unit cycle, a palm button is depressed to energize the solenoid air valve. The air cylinder retracts to unlock the workpiece. At the same time, and with the same electrical impulse, a one-way solenoid air valve is opened to emit a blast of air in the fixture and eject the part. Cycle time is about six seconds.

The tapping machine is of the same general construction as the reaming machine, with power units mounted in the same relationship to the workholder but drawn farther back. Because of the properties of the silicon aluminum metal and because in some cases only three threads are actually formed, it was determined that lead screws must be used to prevent tearing, damaging or stripping of the threads. Lead screws of the proper pitch are used with the driving tangs adapted to fit standard self-reversing tapping attachments. Reversing the motor as frequently as production required would have overheated and burned out the motor.



TAPPING MACHINE power units are farther from the work but similar in angular relationships to the reaming machine. Unit at left is specially mounted so it can be withdrawn to provide access to the workholder. Operation of the tapping machine is identical with the reaming machine.

The lead-screw nuts are adapted to spacers that are permanently fixed to individual baseplates. Through these, the various lead screws operate. The tang end of the lead screw fits into the collet chuck of a self-reversing tapping attachment, which in turn is held in the drilling unit. To prevent the tapping attachment from rotating, loose fit guide rails are provided to receive the extension arms.

Each lead screw is threaded through its nut and into the tapping attachment collet at the middle of the attachment idling space. When the units are energized, the drilling unit spindle moves forward until the tapping attachment engages the forward stroke rotary motion. At the predetermined depth, the drilling unit retracts and pulls the tapping attachment back, which reverses the direction of the collet and lead screw. At the end of the return stroke, the tap automatically rides back until the clutch in the attachment is in the neutral position where it stays until the drilling unit spindle again moves the attachment forward.

All of the drilling units are alike in physical dimensions but the reaming units operate at higher speeds. To provide universal replacement units that could be put into any position on either machine, two-speed units are used as stand-by equipment. One wiring hook-up adapts these units for reaming, the other adapts them for tapping.

Economy, simplicity and ease of maintenance of the tapping attachment and lead-screw assembly can be used in many tapping operations. Conversion from one lead screw to another is all that is necessary to change from one thread pitch to another.

DESIGNED FOR PRODUCTION

PRESS CYCLE

accurately set for optimum production



Setting up a multiple cam limit switch to control the cycle of a 450-ton variable-speed double-acting press is usually an unscientific process that may, but probably does not, yield optimum results. Danly Machine Specialties, Inc., Chicago 50, Ill., with the aid of \$10,000 of electronic equipment and some imagination, has arrived at an exact method, which includes the first known simultaneous recording of the various variables of the drive.

The press on which this technique was first tried, is equipped with an eddy-current clutch and brake, allowing the motor to run continuously. Controls operate so the free part of the duty cycle runs faster than that for standard presses, with a slow down to desired speeds during the working part of the cycle. When operating continuously, the press has a stroke rate of 14 per minute; about 50 percent faster than standard double-acting presses of this size.

To achieve the varied linear speed of the ram, an eleven-cam limit switch energizes the clutch and the brake for varying periods and in a definite sequence. Operating positions of the cams can be

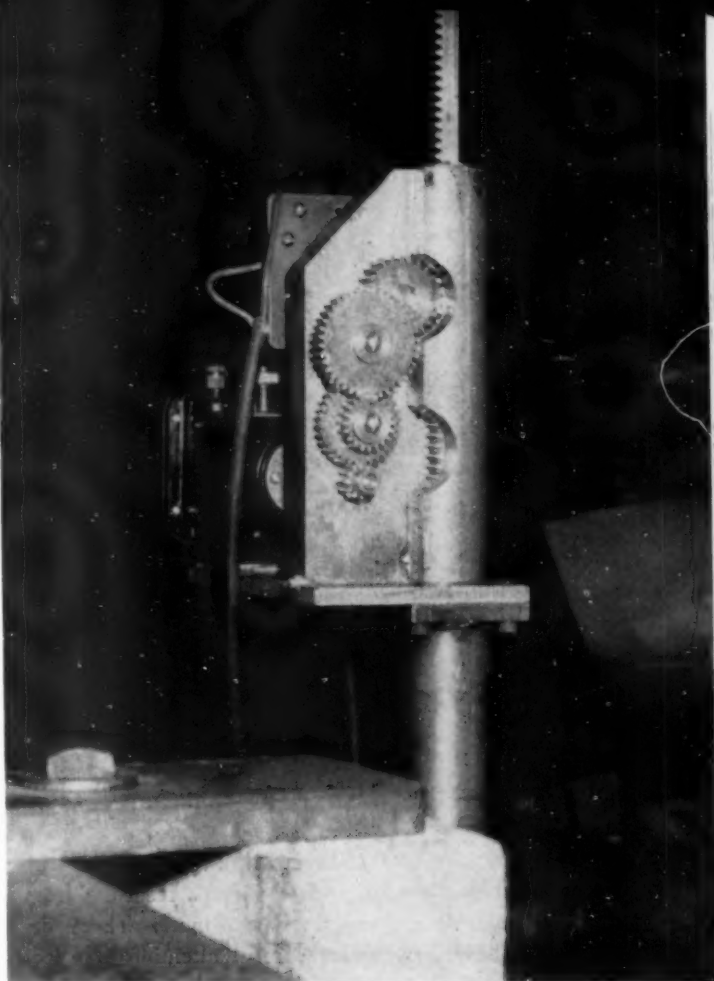
TYPICAL DOUBLE-ACTING, straight side press, with decelerated motion during the draw period, on which the described recording was made. Cycle characteristics are obtained by setting an eleven-cam limit switch to control the energized and de-energized periods of an eddy current clutch and an eddy current brake. The press must be mounted to set the switch cams located on top of the frame. Electronic measuring equipment is mounted on a dolly so it can be transported where needed.

THE SIMPLE GEAR TRAIN is the heart of the mechanical equipment required to accurately record ram position and velocity as a function of time. The ram, fastened to the slide, descends through the stationary unit. The pinion is direct-connected to a potentiometer, which can operate through several resolutions and which indicates ram position as a function of added circuit resistance. A three-step gear set, of which the pinion is the first gear, multiplies the rack speed and operates a d-c generator, the output of which is proportional to ram velocity. Both signals are simultaneously plotted by the recorder.

estimated from past experience. Then, instead of tearing several blanks while finer adjustments are made by trial and error, the recording and measuring instruments are mounted on the press and a chart, similar to the one illustrated, is produced on a six-channel recorder.

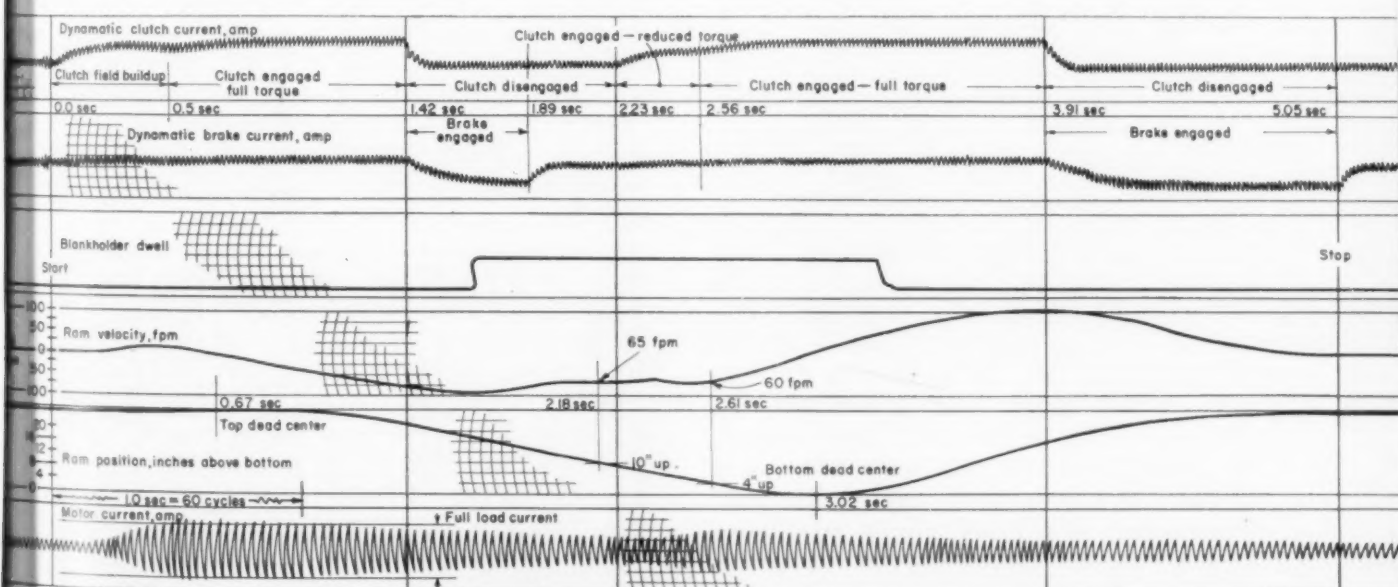
The chart can be analyzed at a glance and further adjustments made so the clutch and brake units operate at the exact times, in the desired amount and for the required periods to give the fastest cycle with optimum draw characteristics. This method can be used for study of new drive characteristics, for setting up new presses during installation tests and for setting up presses for production runs.

The chart was made with the press in intermittent operation at a stroking rate of 11.9 per minute. Ram stroke was 26 inches.



WITH THE PRESS under intermittent operation, set for a 30-percent slow down during the draw and with neither blank nor dies in position, this chart indicates the time-function of all elements of the drive. Requirement for this particular press operation is for constant ram velocity of 60 fpm for the period when the ram is between 10 and 4 inches above bottom dead

center. The multicam control switch is adjusted to give higher and nonconstant values because the press is set up without dies or blanks. The press is not stopped on top dead center so this chart starts a little before that point. If this chart does not indicate the desired cycle characteristics, its study indicates what should be changed, by how much and at what time.



PREVENTING PRESS FAILURES

maintenance and operation

By A. F. Gagne, Jr.*

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DETECTION AND LOAD CONTROL devices can usually prevent power press smashups resulting from momentary carelessness of personnel. These devices, however, require careful attention. Neglect and indifference can ultimately destroy the most carefully designed equipment.

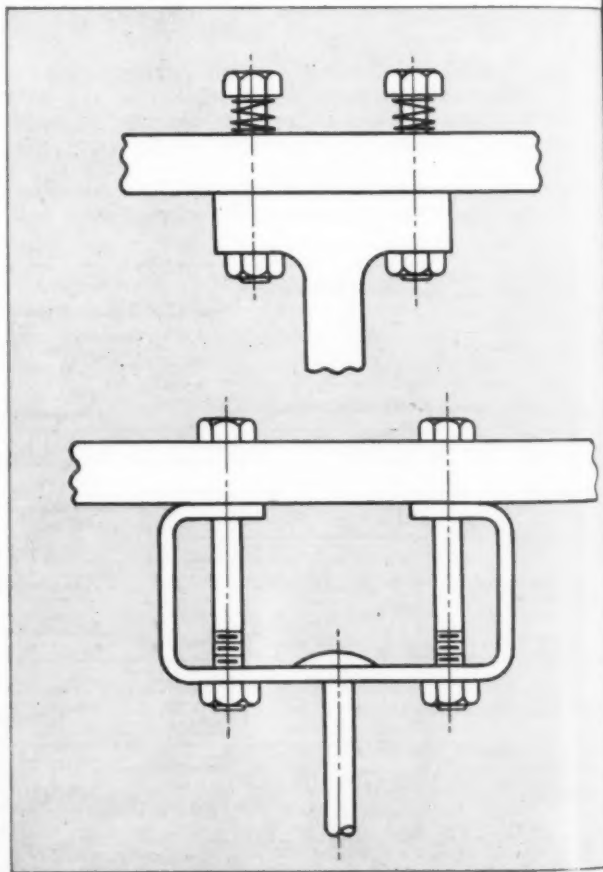
Industry is becoming increasingly aware of the advantages of preventive maintenance. Regular equipment inspection often reveals minor troubles that would eventually develop into major breakdowns. Minor adjustments and repairs are usually made immediately. But major repairs, such as replacement of worn bearings, are scheduled for a time that will not interfere with production, if possible.

Preventive Maintenance

Many unsatisfactory conditions can be found by examining the finished work. Blanked parts should be examined periodically for scratches or high burrs. Even when unimportant from the standpoint of product quality, this check is helpful in determining the proper time for tool regrinding.

Wear of blanking tools takes place at two different rates. In the first stages the edges round smoothly and slowly. As pressure on the edges increases, they begin to deteriorate quickly and may spall or nick. Without overload protection on the press, ultimate load build-up may cause punch breakage, or damage the die, stripper or press. The transition from normal wear to rapid breakdown can often be detected by a regular hourly or

Fig. 1. If bolt is relatively stiff and connected members are springy (top), bolt tension varies with load and nuts might loosen. When connected members are stiff and bolt is springy (below), there is no change in bolt stress if load does not exceed preload of the bolt. Compression springs are shown to illustrate the action of properly torqued nuts.



*Senior member ASTE Binghamton chapter.

ly measurement and plot of burr height on a quality control chart. Alternately, the optimum change time for very high production parts can be established by comparing production per wheel grind with the amount of metal ground off to recondition the tool.

Clearance between punch and die can be checked by inspecting the band of bright, burnished metal around the circumference of the blank or pierced slug. If misalignment exists for any reason, the height of the bright band will be irregular. Misalignment may result from a variety of causes, but prime offenders are worn stripper bushings, worn die set guides and inaccurate setup. It is suggested that the tool inspector determine whether the bolster and ram surfaces were properly cleaned before setting the die. He should also check the die's location in the press. Off-center dies produce unbalanced reactions. Dies in inclined presses should be examined for a possible sidewise shift.

Drawn parts show different symptoms. Scratches down the side of the shell indicate a scored die. Other trouble indicators are cracks starting from the top edge of the shell, due sometimes to insufficient die clearances, and alternately shiny and dull vertical bands which are wrinkles resulting from insufficient blank-holder pressure or inadequate die radius. Thinning of metal, or tiny cracks or tears near the bottom indicate that the metal is being worked excessively, the blank-holder pressure is too large or the die radius is excessive. In hot-chamber dies the inspector should watch for brightly burnished bottom areas, which warn of press overload.

Bolts, nuts and other fasteners should be checked monthly for tightness. The engineer should specify self-locking fasteners and avoid designs that cause fasteners to loosen, *Fig. 1*. Properly tightened fasteners stay tight only if bolt tension is constant and does not vary with each cycle. Increases of tension cause the nut to expand slightly. Decreases of tension permit the nut to contract again. These minute elastic expansions and contractions eventually permit the nut to back off.

Lubrication fittings should be inspected while checking fasteners. Inspection of automatic lubrication devices is especially important because loosening of some connecting line otherwise might not be discovered until the parts are irreparably damaged. Other defects to be looked for are air leaks, cracked castings, worn or scored bearing and gibs, corroded plungers, broken gear teeth and broken springs.

Many parts fail progressively—an internal flaw or a microscopic fatigue crack propagates slowly until the remaining metal is unable to carry the load. Since sudden failure of a primary press member can cause extensive damage to other parts, some press builders and users are applying detec-

tion techniques such as penetrating dyes, magnetic powders, radiography and ultrasonic inspection to check soundness of important forgings and castings. Although a small flaw may not be serious, its possible growth can be detected and efforts made to stop it. These methods have been used for inspecting guide columns, strain rods, base pads, die blocks, pistons, gland nuts and pump shafts.

Periodic electrical checks should also be made. Wiring and motors should be inspected with meggers. This check should not overlook auxiliaries. An operator relying on a supposedly safe device might neglect ordinary safety precautions. Designers can help by using fail-safe design features. Certain design techniques can be used to stop the press if a switch, solenoid, transformer or air supply should fail.

Die setters should be required to replace mushroomed lead hammers, handleless files and stretched wrenches. It should not be necessary for die setters to search through junk piles for bolts, nuts and filler plates. Sometimes expensive precision dies are set on a warped plate and held down by bent, half-stripped bolts. Worn bolster plates should be resurfaced and stripped bolt holes reconditioned with thread inserts. Inspectors should be alert for

Fig. 2. Three-quarter-inch thick clear acrylic press guard protects operator's hands and prevents injury from flying metal.



—Photo courtesy Rohm and Haas Co.

bent washers, makeshift clamps and bolts with rounded heads.

Record keeping is an important phase of preventive maintenance. Companies using check lists covering all equipment and parts to be inspected have found them worthwhile. Lists should be prepared by the engineering department by consulta-



—Photo courtesy Minneapolis-Honeywell Co.

Fig. 4. Two-hand clutch control attachment protects operator. Both switches must be pressed at same time to actuate press. If one switch is pressed, tripping mechanism fails and must be reset by button on control box (not shown).

tion with the operating foreman, die setters, maintenance department and equipment suppliers. Check lists prevent duplication of effort and help to assure that important points are not inadvertently neglected.

An effective plan for controlling maintenance expense has been developed by Westinghouse Electric Corp. The plan provides the tool design and manufacturing departments with information which yields a true picture of product quality and cost, and which helps reduce tool failures, defective quality, and production losses and delays.

In this system, a record tag, Fig. 3, is tied to a die at the start of each run. The tag records dates, approvals and print numbers, material specification and thickness, press number, piece count at the end of the run, and the reasons for stopping the run. If trouble occurs, the tag is given a code number taken from a card listing 105 different causes of trouble. If the die is expensive, the number of hours required to repair it and the amount ground from the punch and die are also shown on the tag. This information establishes the optimum run length of a die and avoids the heavy wear, chipping or breakage that results when a die is run too long.

Record tags aid in the selection of the proper

Fig. 3. Recorded die history on tag is used to determine optimum run length and reduce die failure. Tag can be filled in by die repairmen, die setters, inspectors or foremen.

DIE RECORD TAG WESTINGHOUSE 20140				SERIAL NO.	TYPE
TOOL NO. 4C 317 T14				1	3
DWG. NO.	ITEM	PRESS NO.	DIE SETTER		
4C 317	1	C-10	J.O.		
CODE NO.	DATE	PIECE COUNT			
1	12-4-53	8,600			
DWG. NO.	ITEM	PRESS NO.	DIE SETTER		
4C 317	1	C-11	J.O.		
CODE NO.	DATE	PIECE COUNT			
2	1-17-54	14,400			
DWG. NO.	ITEM	PRESS NO.	DIE SETTER		
21-B-115	9	C-11	V.P.		
CODE NO.	DATE	PIECE COUNT			
3	2-21-54	30,100			
DWG. NO.	ITEM	PRESS NO.	DIE SETTER		
4C 317	1	C-10	J.O.		
CODE NO.	DATE	PIECE COUNT			
4	2-30-54	25,000			
DWG. NO.	ITEM	PRESS NO.	DIE SETTER		
5					
END OF DIE RUN CODE (NO DIE REPAIRS REQUIRED)					
1. END OF ORDER		3. PROD. REQUEST			
2. OUT OF MAT'L		4. MAT'LOVER/UNDER SIZE			
DIE REPAIR CODE (FILL IN CODE NO. AS INDICATED ON CHART)					
1.2					

—Courtesy Westinghouse Electric Corp.

press for re-running dies. This makes it unlikely that punches will be broken due to excessive impact velocity. The tag helps correlate performance with type of stock and helps assure the use of correct stock thickness.

There are usually one or two major causes when maintenance hours are excessive. A written record of repeat repair orders helps engineering and supervision find solutions and justify corrective measures. Such maintenance records are invaluable to development engineers for evaluating new die construction and materials, such as special surfacing treatments, or new punch steels and heat treatments. Also, written records minimize confusion and loss of instructions and data on night shifts.

In addition to realizing the primary goals of improving die design and manufacture, and establishing best performance conditions for a given die, the Westinghouse program has resulted in:

1. All personnel have become more alert. Minor machine difficulties are discovered before they become serious.

Standards of performance have been established for specific materials and types of operation. Close forecasts of the most economical length of die run can be made for new dies.

Complete records have enabled engineers to calculate in advance whether or not an expensive detection device is justifiable. Without proof, the operating department may veto purchase of necessary safety equipment.

Safety

Smash-up prevention and personnel safety are closely related. Aside from its purely humanitarian aspects, safety pays. Accidents result in repair bills for damaged equipment, costly production interruptions and increased compensation insurance rates. All personnel should be actively concerned with safety. Poor housekeeping and dangerous conditions should be promptly reported, regardless of job level.

Power presses are the cause of more amputated fingers than any other type of industrial equipment. Supervision should examine each operation for properly guarded dies, flywheels, gears and belts. Among the many effective die guards available, are plastic shields, *Fig. 2*, wire cages, pull back and sweep guards to clear the danger area, pneumatic or electric two-hand controls, *Fig. 4*, and gates or photoelectric devices to stop the press if the operator should enter the danger area. While some devices are not applicable to all needs, guards are available for every condition.

Poorly designed or makeshift press guards undeniably will hinder production. However, guards that are substantial and follow good practice will increase output as much as 15 percent. This results from added operator confidence, improved rhythm and avoidance of the distraction of keeping out of danger.

Although mechanical handling devices are usually installed simply to increase production, they offer major safety benefits. A dial feed is a much safer method of feeding a die than hand insertion. They give higher output because they minimize hand travel distance and permit the operator to use the full cycle to position the work. The automatic ejection of parts also improves safety along with production rates.

A press that makes two strokes where only one is expected creates a serious safety hazard. Guarding will protect the operator but not the equipment. As a result, a nonrepeat safety clutch is being supplied as standard equipment on most new mechanical presses. This clutch requires the operator to raise and lower his foot on a pedal for each stroke, helping to assure that the machine will trip only once and not close on a half-positioned or half-ejected part. Certain types of air-operated clutches have a tendency to repeat if the valve sticks. A

specially designed solenoid valve, *Fig. 5*, provides essentially positive protection against sticking or other failure. Both valves must cycle together each stroke to start the press. If for any reason only one valve reverses, the unit fails safe and the press stops. The probability that both valves will fail simultaneously is remote.

Die setters working with conventional presses and dies can be protected by disengaging the clutch and throwing the belt off the flywheel, and by locking out the motor safety switch. A wooden block placed under the ram prevents the ram from lowering as a result of a defective press brake.

Presses used to produce rubber and plywood products have hazards not found with conventional presses. It is sometimes necessary to roll out press platens after each stroke to permit unloading of finished articles and reloading of raw materials. Since it is impractical to stop the hydraulic pump with each stroke, electrical or hydraulic platen position detectors, *Fig. 6*, are available to prevent accidental raising of the press when the platens are removed.

Operation and Personnel Instruction

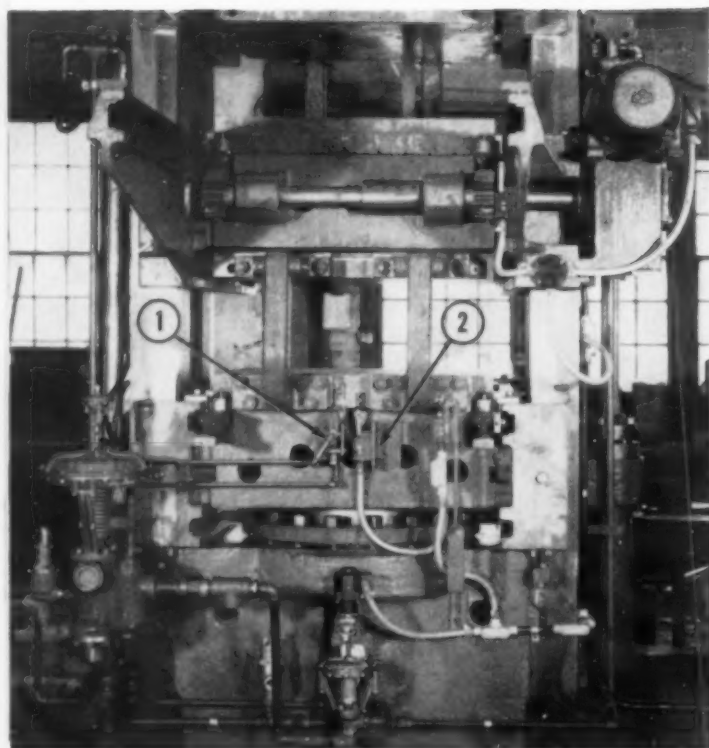
Proper training of personnel is essential in helping prevent press smash-ups in any pressroom. Regardless of how well safe-guarded the press is, it can still be jammed by carelessness or lack of experience.

Although the tool engineer usually has little to do with training, he can make the equipment easier to operate. Important instruments and gages should be mounted where they can be easily read from the

Fig. 5. Dual air valve with two solenoids and pneumatic interlocking of both main and pilot sections prevents double stroking of presses equipped with air-operated clutches and brakes.

—Photo courtesy Hannifin Corp.





—Photo courtesy Adamson United Co.

Fig. 6. Pneumatic, 1, and electric, 2, interlock attached to a rubber molding press. Mechanism prevents the ram rising while press platens are removed.

control position. Controls should be located where they are convenient to use in the normal working position. If several control buttons are close together, labels should be used to prevent confusion.

Protruding mushroom-head stop buttons should be used for instant location. Start buttons should be shielded against accidental contact. Several stop buttons located at strategic points may be a good precaution on large equipment, but there should be only one start button.

If several control levers or wheels are used, they can be combined into one control, possibly similar to an automotive gearshift. One-lever control simplifies the operation and automatically interlocks against mixup. Whenever possible, if pushing a lever forward starts a motion, pulling it back should stop that motion. This precaution lessens the danger of an operator damaging a press during confusion or panic. Handles should be arranged to move in the direction the equipment will travel.

A pedal or lever requiring excessive force is fatiguing and slow to operate in an emergency, but such equipment should not be too sensitive. Knobs should be small for fast, light operations. If considerable force is needed, power boosters and large wheels and/or counterweights are helpful.

Other operating aids include interlocks and guards. Danger areas, such as the insides of guards or switch boxes, can be effectively indicated by orange paint. Areas into which the operator is required to put his hands or tools should be well lighted.

Material Control

Because one lot of material may have performed perfectly on the press is no assurance that the next lot will do the same. Simple checks are desirable to intercept inferior stock before it causes press trouble or defective work.

Visual inspection is useful if done by experienced workers. Stock should be examined for slag stringers, dirt or a thick oxide layer, which can cause tool abrasion and are apt to result in tears or bottom punch-outs in drawing operations. Brass is subject to dezincification in pickling and should be checked for the characteristic coppery stains.

The basic material control instruments are the micrometer and the hardness tester, which checks completeness of anneal and helps guarantee stock performance on punching, bending and drawing operations. Bending metal 180 deg flat on itself is a simple ductility test used in the absence of a hardness tester. If this can be done both with and across the grain without producing cracks, the metal is sufficiently ductile for most draw operations. Actual draw or cupping tests on a laboratory press are often used, but the results must be interpreted to be sure they accurately indicate shop performance. If possible, the tests should be conducted at the same speed as the actual operation.

A microscope can be used to learn the carbon percentage and grain size, important to draw performance and resultant surface finish. Used with brass, the microscope reveals the presence of any unabsorbed zinc or lead at the grain boundaries, which may cause draw tears. Directional properties of the metal, the cause of dog-earing, cracking and tearing, can also be discovered with a microscope, although quick and accurate results are achieved on steel with the recording torque magnetometer, developed by U. S. Steel Corp.

This is last in a series of articles on preventing press failures. Although it has been impossible to cover the entire field, approaches were given when details were omitted. It is hoped that the suggestions made and the equipment discussed will aid the reader in solving at least some of his problems.

Acknowledgements

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BENDING ALUMINUM TUBING

...new production data

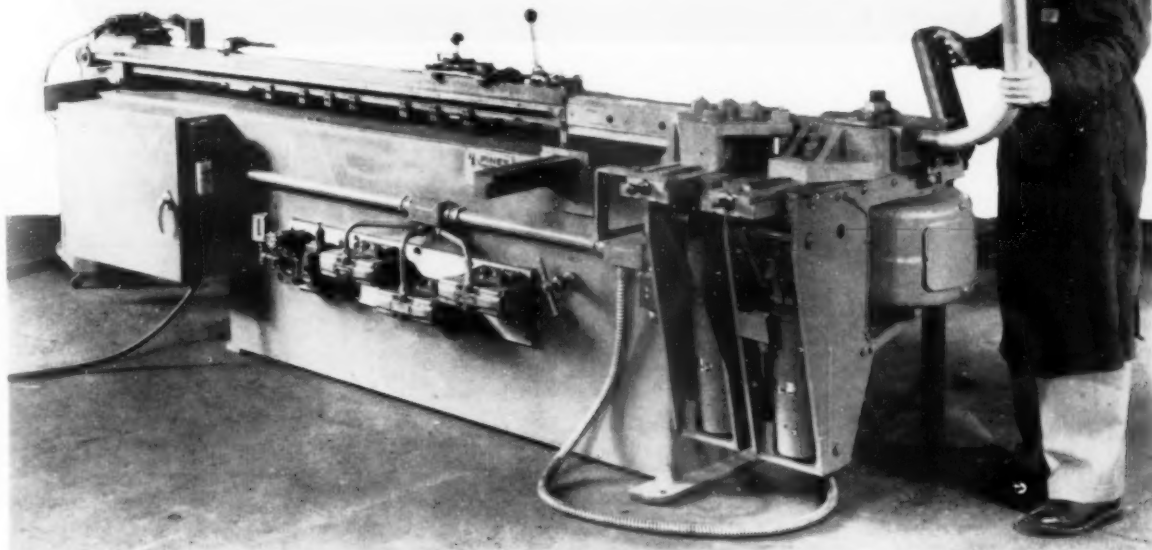


Fig. 1. Automatic bender, on which tests were conducted, making a two-diameter bend in 2½-inch aluminum aircraft tubing.

By J. E. Hawking*

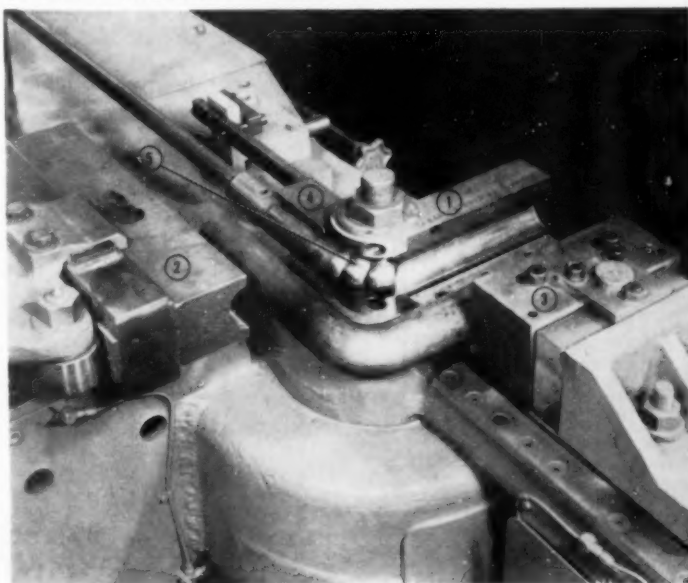
Pines Engineering Co., Inc.
Aurora, Ill.

RESULTS of a recent series of tests have added new information to that already known on the bending of aluminum alloy tubing. Tests were made on tubing ranging in diameter from ½ to 1¾ inches, and in various alloys, wall thicknesses and tempers to determine which sizes and alloys could be successfully bent to centerline radii of one or two diameters.

Tests were made in a standard Pines automatic bender, Fig. 1. The draw-bend principle of forming was used with a two-ball mandrel and a wiper die. Mandrels are standard to prevent tube collapse during bending, and the wiper die, Fig. 2, fits gap between the straight tube and the round bending form at or just behind the tangent point. The wiper prevents wrinkles that tend to form on the inner wall of the tube. The mandrel was lubricated.

Results of the tests are outlined in the accompanying table. The word "No" indicates those sizes and alloys in which satisfactory bends could not be made, "Flat" indicates those sizes and

Fig. 2. Close-up of tooling used to bend 2-inch tubing to a 2-inch centerline radius. Tooling comprises: (1) bending form, (2) pressure die, (3) clamp die, (4) wiper die and (5) two-ball mandrel.



*Associate member ASTE Fox River Valley chapter.

alloys that developed excessive flatness and "Yes" indicates sizes and alloys in which satisfactory, smooth wrinkle-free bends were successfully made. Where no results are listed, either the materials or the tooling were lacking. Spaces are left for all alloys, tempers and sizes because the probability of successful bends can be anticipated by checking bendability of alloys and sizes surrounding the

desired one.

Bending of aluminum tubing is not limited to the sizes shown. Tests were conducted on these sizes because they are most widely used. In general, it was determined that successful bends can be made to centerline radii of one diameter in 52SO alloy, and that bends to radii of two diameters are successful in tubing of most other alloys and tempers.

Guide Chart for Bending Aluminum Alloy Tubing

Alloy and Temper	Wall Thickness (inches)	Tube Diameters (inches)							
		1/2	3/8	1/4	7/8	1	1 1/4	1 1/2	1 3/4
Centerline Radii Equal One Diameter									
3SH14	0.035	No	—	—	—	—	—	—	—
	0.049	No	No	No	—	No	—	—	—
	0.065	Flat	Flat	No	No	No	—	—	No
3SH18	0.035	No	—	—	—	—	—	—	—
	0.049	No	—	No	—	—	—	—	—
	0.065	No	—	No	—	No	—	No	No
52S0	0.035	Flat	—	—	—	—	—	—	—
	0.049	Flat	—	Flat	—	—	—	—	—
	0.065	Yes	—	Yes	—	Yes	—	—	—
61ST4	0.035	Flat	—	—	—	—	—	—	—
	0.049	Flat	—	No	—	—	—	—	—
	0.065	Flat	—	Flat	—	Yes	—	—	—
61ST6	0.035	No	—	—	—	—	—	—	—
	0.049	No	No	No	—	—	—	—	—
	0.065	Flat	No	No	No	No	—	—	—
63ST5	0.035	—	—	—	—	—	—	—	—
	0.049	—	—	No	—	—	—	—	—
	0.065	—	No	No	—	—	—	—	—
63ST6	0.035	—	—	—	—	—	—	—	—
	0.049	—	No	—	—	—	—	—	—
	0.065	—	—	No	—	—	—	—	—
63ST83	0.035	—	—	—	—	—	—	—	—
	0.049	—	—	No	—	No	—	—	—
	0.065	No	—	No	—	—	—	No	No
Centerline Radii Equal Two Diameters									
3SH14	0.035	Flat	Yes	—	—	—	—	—	—
	0.049	Yes	Yes	Yes	—	Yes	—	—	—
	0.065	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
3SH18	0.035	No	—	—	—	—	—	—	—
	0.049	Yes	—	No	—	No	—	—	—
	0.065	Yes	—	Yes	—	Yes	—	No	No
52S0	0.035	Yes	—	—	—	—	—	—	—
	0.049	Yes	Yes	Yes	—	Yes	—	—	—
	0.065	Yes	Yes	Yes	—	Yes	—	Yes	—
61ST4	0.035	Yes	—	—	—	—	—	—	—
	0.049	Yes	—	Yes	—	Yes	—	—	—
	0.065	Yes	—	Yes	—	Yes	—	Yes	Yes
61ST6	0.035	Yes	Yes	—	—	—	—	—	—
	0.049	Yes	Yes	Yes	—	Yes	—	—	—
	0.065	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—
63ST5	0.035	—	—	—	—	—	—	—	—
	0.049	—	—	—	—	—	—	—	—
	0.065	—	—	—	—	—	—	—	—
63ST6	0.035	—	—	—	—	—	—	—	—
	0.049	—	Yes	—	—	—	—	—	—
	0.065	—	—	Yes	—	—	—	—	—
63ST83	0.035	—	—	—	—	—	—	—	—
	0.049	—	—	No	—	No	—	—	—
	0.065	Yes	—	—	—	—	—	No	No

increase tap-drill DIAMETERS and save money

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SINCE THERE IS NO ADVANTAGE in producing threaded connections that are stronger than the bolt used in the connection, the effect on strength of varied tap-drill diameters is of interest. Recent tests have determined the optimum relationship existing between strength of threaded connections, Fig. 1, and tapping expense. This optimum condition exists when the hole is such that when tapped the shear strength of the engaged threads is equal to the tensile strength of the bolt body. Internal threads of a height greater than that for maximum strength of the assembly are difficult to make, require a high torque for the tapping operation and frequently are the cause of excessive tap breakage.

Present practice is to specify tap drills that will produce approximately 75 percent of full thread engagement. This means that only the outer 75 percent of the external thread form, measured radially, is engaged by the internal thread. Calculations to determine percent of full thread engagement are normally based on the nominal values of the tap major and minor diameters, and the tap drill or hole diameter. Putting this in the form of an equation:

$$T = \frac{D_r' - D_n}{D_r' - D_r''} \times 100$$

*Senior Member ASTE Houston chapter.

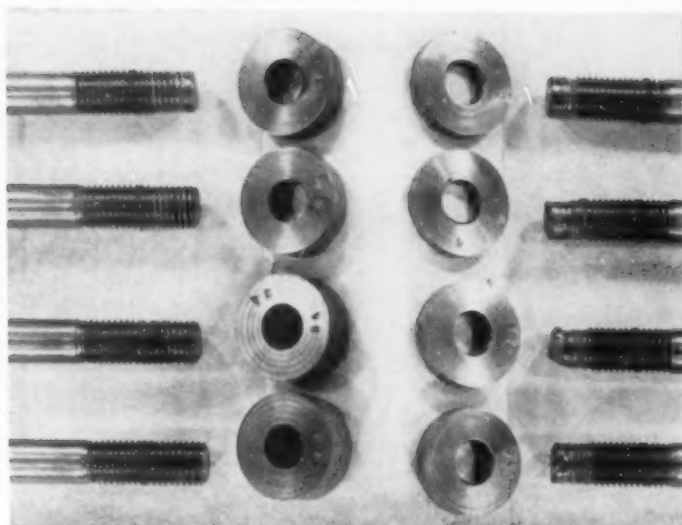
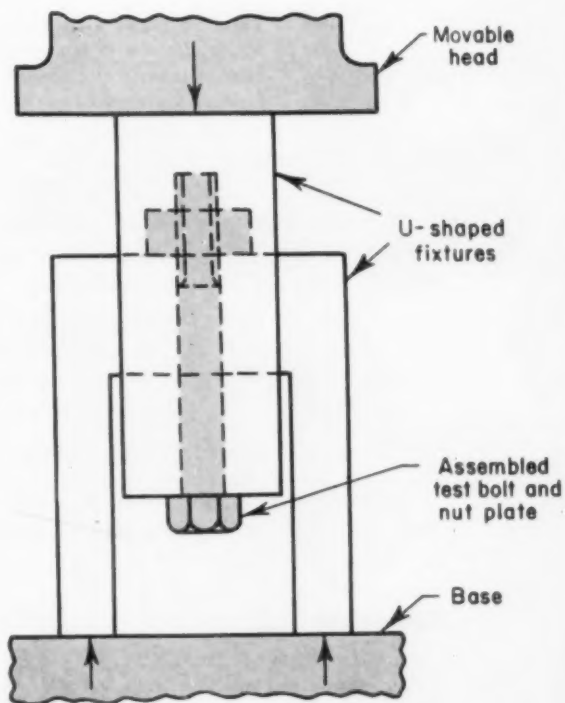
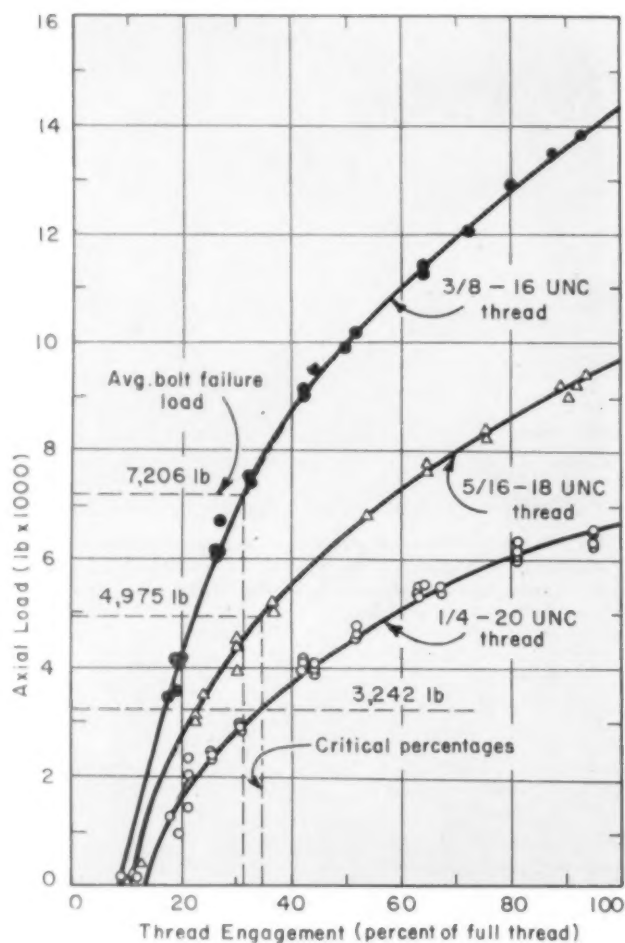


Fig. 1. Shear failures of bolts at various percentages of thread engagement. Simple shear is illustrated by specimens at the left, while at the right more complex failures are visible.

Fig. 2. Assembled bolt and nut plate loaded in tension by applying compression load to a two-part fixture.





where

T = Thread engagement, percent
 D_r' = Major diameter of tap, inches
 D_r'' = Minor diameter of tap, inches
 D_H = Hole diameter, inches

Test Specimens

The bolts used as test specimens were all bright SAE 1018 steel hexagon head cap screws with cut threads in the following nominal sizes:

$\frac{1}{4}$ — 20 UNC — 2A by $2\frac{3}{4}$ inches long
 $\frac{5}{16}$ — 18 UNC — 2A by $2\frac{3}{4}$ inches long
 $\frac{3}{8}$ — 16 UNC — 2A by $2\frac{3}{4}$ inches long
 $\frac{1}{2}$ — 13 NC — 2 by 3 inches long
 $\frac{5}{8}$ — 11 UNC — 2A by 5 inches long
 $\frac{3}{4}$ — 10 UNC — 2A by $5\frac{1}{2}$ inches long

All nut plates were cut from $1\frac{3}{4}$ -inch cold-rolled steel bar. The cut surfaces only were machined to obtain nut thicknesses.

Equipment

The taps used in these tests were Morse style No. 2046, plug type, commercially ground high-speed steel. None of the taps had been used previously

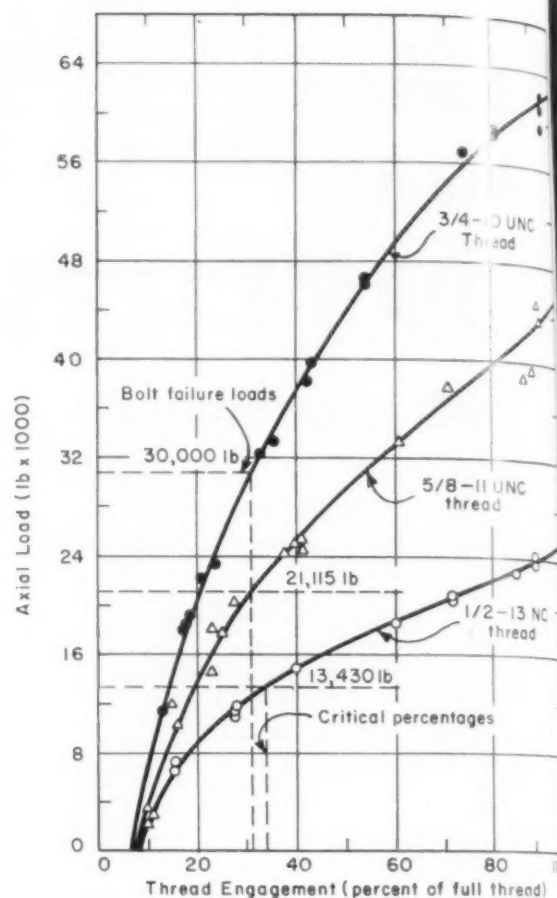


Fig. 3. Test loads for failure of threaded connections at various percentages of thread engagement for $\frac{1}{4}$ to $\frac{3}{8}$ -inch diameter bolts. Average loads that caused tension failure of the bolts and critical percentages of engagement are indicated for each size.

Fig. 4. Test loads for failure of threaded connections at various percentages of thread engagement for $\frac{1}{2}$ to $\frac{3}{4}$ -inch diameter bolts. Average loads that caused tension failure of the bolts and critical percentages of engagement are indicated for each size.

and only one tap was used for tapping all holes of the same size.

All specimens were tested on a Southwark-Tate-Emery 120,000-lb hydraulic testing machine with the bolt and nut assembly mounted in U-shape fixtures, Fig. 2. When the bolt and nut plate were assembled to hold the two U-shaped parts together, compression force exerted on the assembly by the testing machine was transformed into an equal tension load on the bolted connection.

Procedure

Fabrication and testing procedures were similar for all specimens. On starting tests of a given

thread size, several nut plates were machined to a thickness equal to the nominal bolt diameter. These plates were then drilled and tapped to provide specimens having approximately 10, 20, 30 and 40 percent of full thread engagement. Combinations of bolts and nut plates were then tested, starting with the lowest percentage of engagement. When the bolt body broke before the threads sheared, the tests were discontinued.

New nut plates were machined to have the same percentages of engagement as the initial plates but were thinner. Since the thinner nut plates had fewer threads engaged, failures again were by shearing of the bolt threads but at reduced loads.

When loads required to shear the bolt threads again approached, or were equal to, the load required to break the bolt, the thickness of the nut plates was again reduced. This procedure was repeated until specimens of all the desired percentages of thread had been tested.

By the time specimens with the maximum percentage of full thread engagement had been tested, enough bolt bodies had failed to provide sufficient data on the strength of the bolt body. When test results for shearing failures were not consistent, additional specimens were fabricated and tested before tests of the next bolt size were undertaken. On completion of each test, the specimen was disassembled, and the tapped hole and sheared bolt threads were examined and measured, where necessary, to determine the type of failure that had occurred.

Critical Percentages

The critical percentage is that radial thread engagement resulting in a strength equal to the body strength of the bolt for a length of engagement equal to the bolt diameter. On each of the curves shown in Figs. 3 and 4, the critical percentages are shown for the respective bolt sizes. Each curve is a plot of the axial loads which were required to shear the threads of a connection at various percentages of full thread.

Although the tests were performed with nut plates of various thicknesses, the test loads were corrected and plotted to apply for a length of thread engagement equal to the nominal bolt diameter. The following equation was used to make this correction:

$$P_c = P_a \frac{t_s}{t_n}$$

where

P_c = Corrected test load, lb

P_a = Actual test load, lb

t_s = Bolt diameter, inches

t_n = Nut plate thickness, inches

This correction equation is based on the theory

that, for a threaded connection of a given thread size and a given percentage of full thread, the thread shear area and resulting strength of the connection are directly proportional to the number of engaged threads. The number of engaged threads is directly proportional to the length of engagement. By plotting actual shearing loads for various nut plate thicknesses, this relationship was found to be essentially correct.

The horizontal dashed lines intersecting each curve are averages of the tension loads that caused failures of the bolt bodies of that size. These intersections determine the critical percentage of full thread at which the shear strength of the threads is exactly equal to the average tension strength of the bolt bodies.

At percentages of engagement less than critical, the strength of a connection is less than its possible maximum value because the threads will shear before the bolt body will break. At percentages of thread greater than critical, the connection is of maximum strength but the internal threads are higher than necessary because the bolts will break before the threads will shear. For the six thread types tested, the critical percentage of full thread was in all cases between 30 and 35 percent. If individual instead of average test values had been plotted, all critical percentages of full thread would have been between 28 and 35 percent.

Theoretically, all curves in the two figures should start at zero percent and zero load if the bolt thread major diameter were its nominal value and

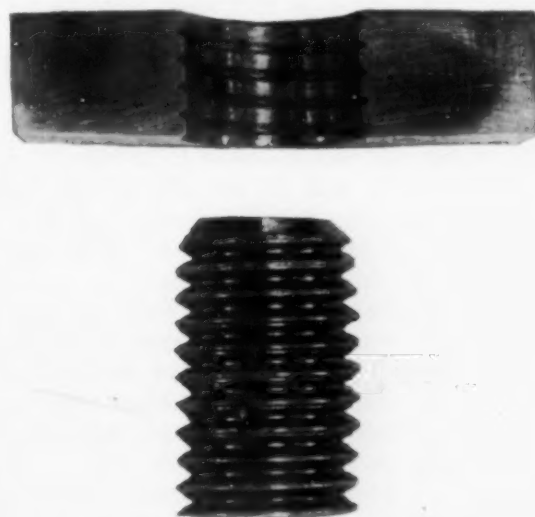


Fig. 5. Cross section, showing initial failure of a $\frac{3}{4}$ -11 UNC thread specimen with engagement of 37.6 percent of full thread.

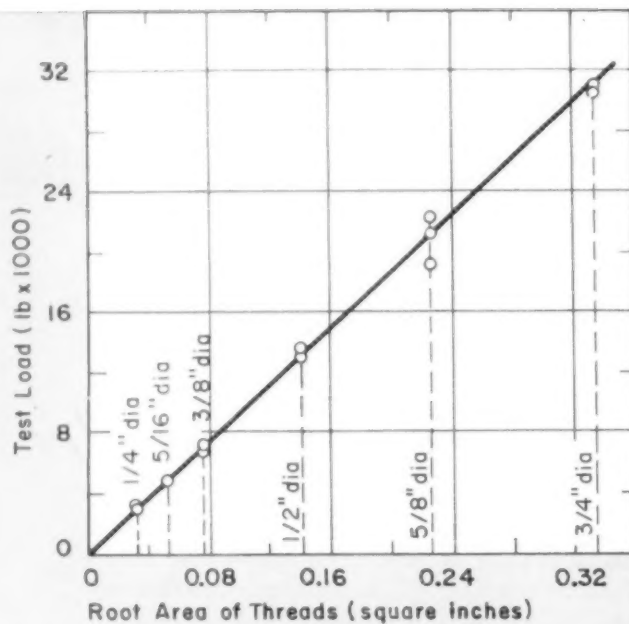


Fig. 6. Curve of bolt body strength against thread tensile stress area indicates good correlation between tests.

that the pressure flanks of the internal threads formed on the flanks of the external threads.

As previously stated, averages of bolt failure loads were used to determine the critical percentages of thread. Because of the limited number of specimens that were tested to failure, a check was made to determine the accuracy of the data by plotting the bolt failure loads against the actual root areas of the bolts, Fig. 6. The curve resulting from this data is a straight line with a slope (31,100 lb per 0.334 sq inch) indicating a bolt material strength of 93,200 psi. The curve indicates close correlation of the various tests.

Optimum Tap Drill Size

The optimum tap drill sizes and the method by which they were obtained are shown in the table. To the critical percentages in the first line was added an allowance to account for experimental error and to provide a margin of safety. The sum of the allowance and the critical percentage is the minimum percentage of thread that would be allowable for the design of a bolted connection. Five percent of thread was selected as the magnitude of this allowance because it includes the deviation of the points from the curves in Fig. 3 and 4 in the critical percentage range.

After the minimum allowable percentages of thread had been determined, these values were converted to equivalent tap drill hole diameters. In all calculations, the actual drilled hole diameters were used rather than the drill size. Although the diameters of the drilled holes averaged only 0.002 to 0.006 inch larger than the drill diameter, values as high as 0.010 inch were observed. These values may be considered excessive for good machine shop equipment and techniques but they are realistic values that must be considered in the selection and recommendation of any optimum tap drill size.

Consequently, the optimum tap drill sizes in the table include the drilling allowances shown. These values were subtracted from the hole diameters that correspond to the minimum allowable percentage of thread. The remaining dimension represents the drill size desired. The next line is the percentage of thread engagement that corresponds to the diameter of the desired drill. To avoid grinding special drills and to be conservative, a drill of the next smaller standard size was selected as the optimum drill. The optimum drill designations, their diameters and the maximum (nominal) percentage of thread that they will produce are shown on the following three lines of the table. The last

equal to the tap-drilled hole diameter of the nut plate. Actually, the major thread diameter of commercial bolts is slightly less than the nominal diameter thus permitting a small indicated percent of full thread to exist at no load as shown in the curves. For the bolts tested, this percent of full thread ranged from 6 to 13 at no load.

Description of Failures

Most of the bolt and nut plate combinations were pulled completely apart to permit their removal from the fixture. Appearance of several 3/4 - 10 UNC specimens after being tested at various percentages of thread is shown in Fig. 1. Up to about 50 percent of full thread, simple failure by shearing of the thin crests of the external threads was apparent. This is shown by specimens at the left that had been machined to provide, from the bottom, 13, 20.8, 33 and 43.3 percent engagement, respectively. Failure appeared to be more complex over 50 percent of full thread. It was indicated by a slow falling off of the load after yielding of the connection had started. When the bolt and nut plate were finally pulled apart, the threads had a galled appearance as shown by specimens at the right. These had been machined, from the bottom, to provide 54, 74.4, 81.3 and 95.5 percent of thread, respectively.

To determine the appearance of the threads immediately after failure, load was removed from several specimens after they had yielded and the specimens were cross-sectioned as shown in Fig. 5. Failure of this connection was primarily by shearing of the bolt threads as evidenced by the steps

Determination of Tap Drill Sizes and Comparison with Other Methods

Item	Thread Sizes and Types					
	1/4-20 UNC	5/16-18 UNC	3/8-16 UNC	1/2-13 NC	5/8-11 UNC	3/4-10 UNC
Test Results						
Critical percentage of thread, percent	34.5	34.5	31.0	34.0	31.0	31.5
Allowance for experimental error and margin of safety, percent	5.0	5.0	5.0	5.0	5.0	5.0
Minimum allowable percentage of thread, percent	39.5	39.5	36.0	39.0	36.0	36.5
Hole diameter corresponding to minimum allowable percentage of thread, inch	0.2245	0.2840	0.3455	0.4610	0.5825	0.7025
Allowance for difference between drill and hole diameters, inch	0.004	0.005	0.006	0.008	0.010	0.012
Desired drill size, inch	0.2205	0.2790	0.3395	0.4530	0.5725	0.6905
Percentage of thread corresponding to diameter of desired drill, percent	45.5	46.5	43.5	47.0	44.5	46.0
Next smaller standard tap drill, designation	7/32	J	R	29/64	9/16	11/16
Actual diameter, inch	0.2187	0.2770	0.3390	0.4531	0.5625	0.6875
Percentage of thread produced, percent	48.5	49.5	44.5	47.0	53.0	48.5
National Screw Machine Products Association						
Tap drill designation	13/64	G	O	Sp. Grind	Sp. Grind	Sp. Grind
Actual diameter, inch	0.2030	0.2610	0.3160	0.4320	0.5455	0.6615
Percentage of thread produced, percent	72.5	71.5	72.5	68.0	67.5	68.5
Commonly Recommended						
Tap drill designation	7	F	5/16	27/64	17/32	21/32
Actual diameter, inch	0.2010	0.2570	0.3125	0.4219	0.5313	0.6562
Percentage of thread produced, percent	75.5	77.0	77.0	78.0	79.5	72.5

six lines provide similar data on the tap drill sizes that have been recommended by others.

Conclusions

Although the results of these tests are specific only to the bolts tested, some conclusions can be drawn concerning the strengths of bolted connections. Regardless of the percent of full thread engagement, the strength of the connection cannot ex-

ceed the strength of the bolt. For maximum strength of bolted connections, holes need not be drilled or tapped to provide percentages of full thread greater than the critical percentage plus allowances. Tap drill sizes listed in the table will produce connections of maximum strength and are considered suitable for normal commercial application. Use of such tap drills will result in great producibility, lower tapping torque and less tap breakage—and consequent production savings.

Automated Records

MANY COMPANIES face a common record problem—functions are decentralized and accounting information must be exchanged constantly between somewhat distant points. Now Remington Rand has designed a procedure particularly suited to this kind of operation. Machines engineered for the job provide for the automatic transfer of data from punched cards into perforated tape at the point of original information. Thus the transfer of data to another distant plant is simplified; there, machinery and punches cards from the tape.

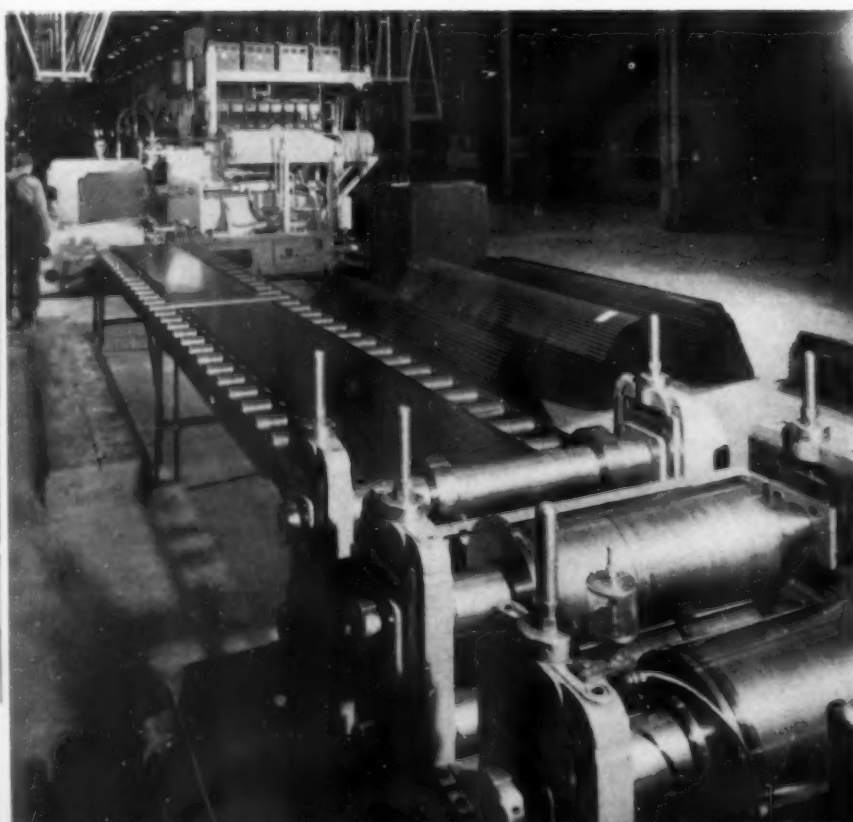
Interdepartmental applications within one location might also benefit from this automated record accounting. Time benefits multiply in examples like this: the engineering department, while typing a bill of materials, can automatically produce a tape for creating cards for use by materials control.

Storage is yet another benefit. Inactive punched-card data transferred onto tape multiplies file capacity by about 500 percent, yet provides a means of quickly reproducing any necessary records when needed.

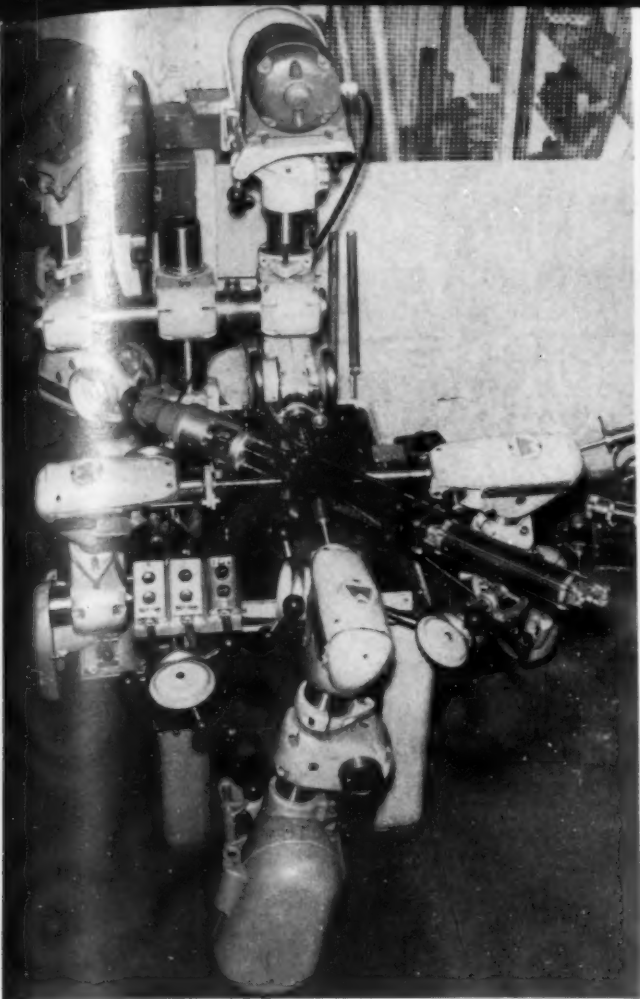
TOOLS at work



AUTOMATIC SEAM WELDING SEQUENCE joins stamped and formed sheet metal parts of food compartments at Westinghouse refrigerator plant in Columbus, Ohio. The top is inserted into the left side of the welder, the bottom into the right. These parts are positioned by guide pins and held in place by electromagnets. The skirt fits over the outside between the top and bottom. After welding, finished compartments are carried to next operation by overhead conveyor at top right of picture.



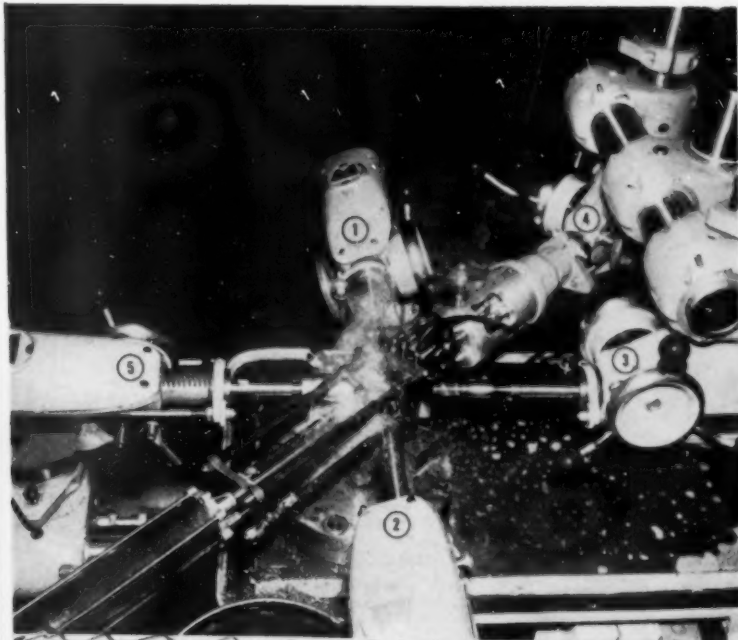
ROLL FLANGING OF SHEETS for refrigerator shells is performed in a continuous operation by this machine in the parts fabrication line at the Westinghouse plant. The sheets have previously been notched and pierced. After flanges have been formed, the sheets, which are long enough to form sides and top of the box, go to the tangent bender in the background where they are shaped like the letter U in a single operation.



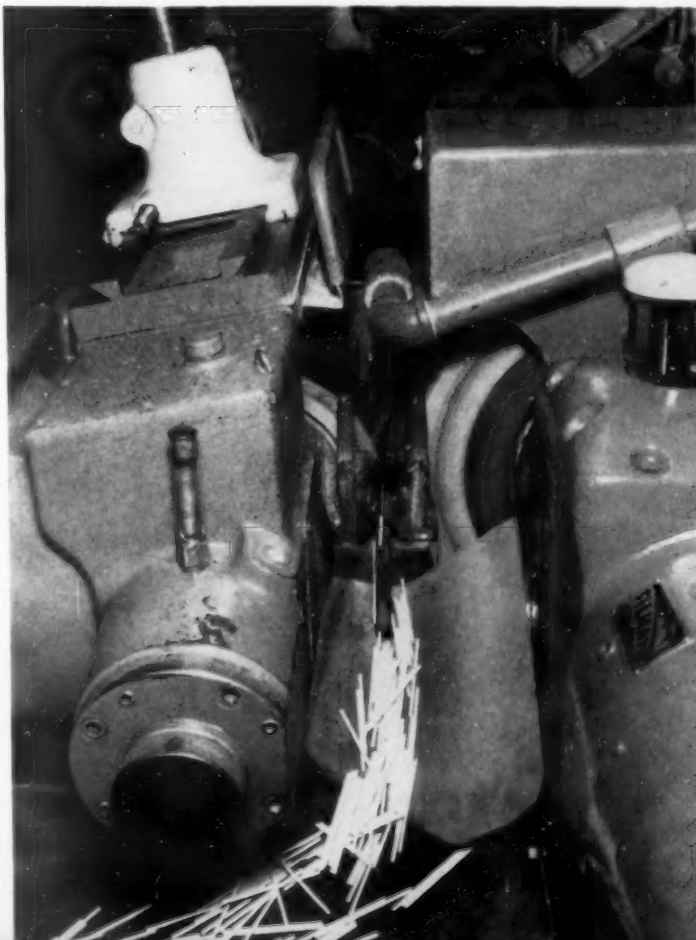
MECHANIZATION adapted for the small plant is illustrated in this setup for machining a high-pressure valve body at Aquapliance Corp., San Jose, Calif. Operations required on workpiece consist of multiple drilling and tapping, core drilling, counterboring and facing. Automation principles are utilized by jiggging part but once and arranging the standard Magna drill heads around the part. Total time including loading and unloading is 30 seconds. Production was increased 400 percent; cost per part dropped from \$1.12 to \$0.16.

PRECISION CENTERLESS GRINDING of ceramic sleeves for electronic applications is accomplished by means of Norton diamond wheels at American Lava Corp., Chattanooga, Tenn. Despite high initial cost this combination was found most effective for high volume production. This setup holds tolerances of 0.0001 inch and permits three times the stock removal rate previously possible.

June 1954



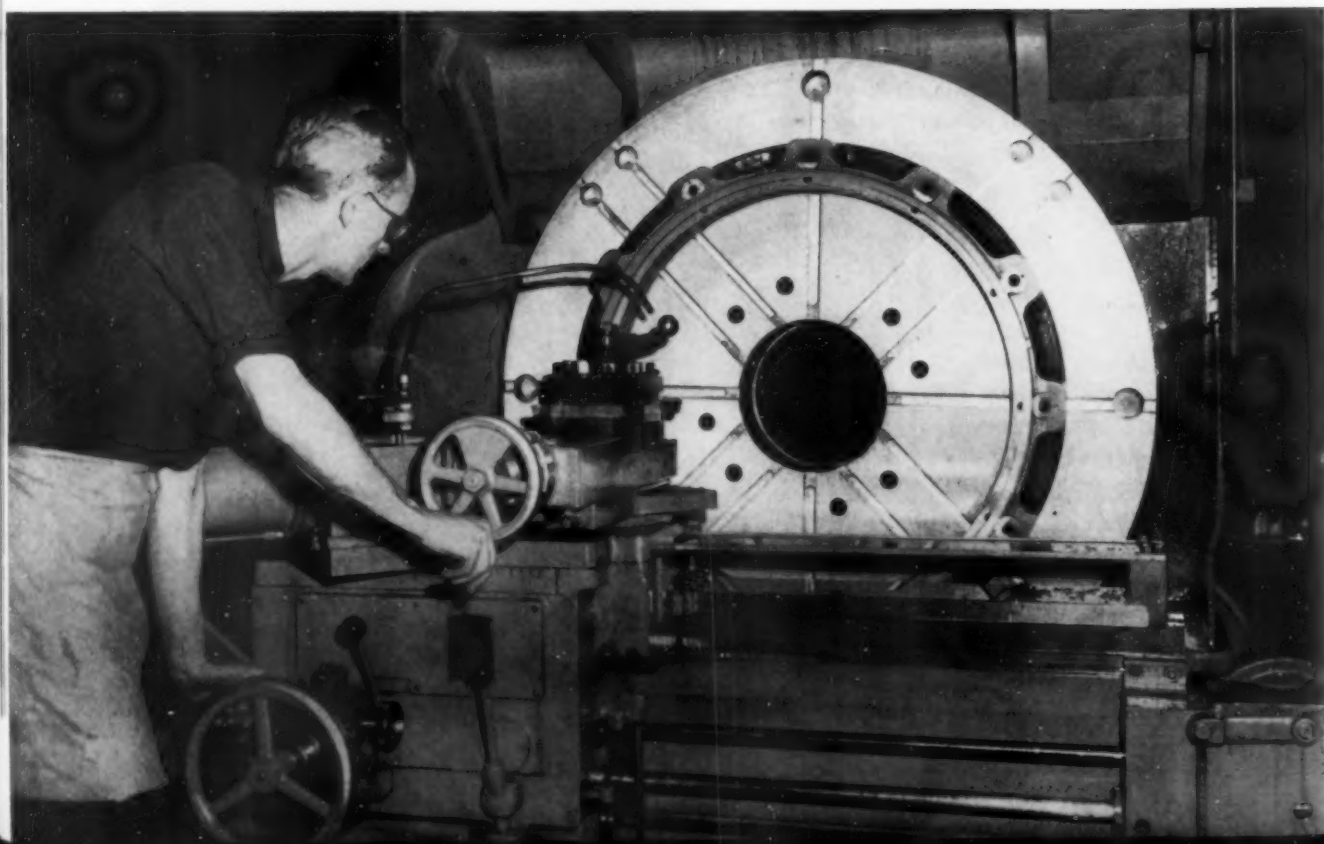
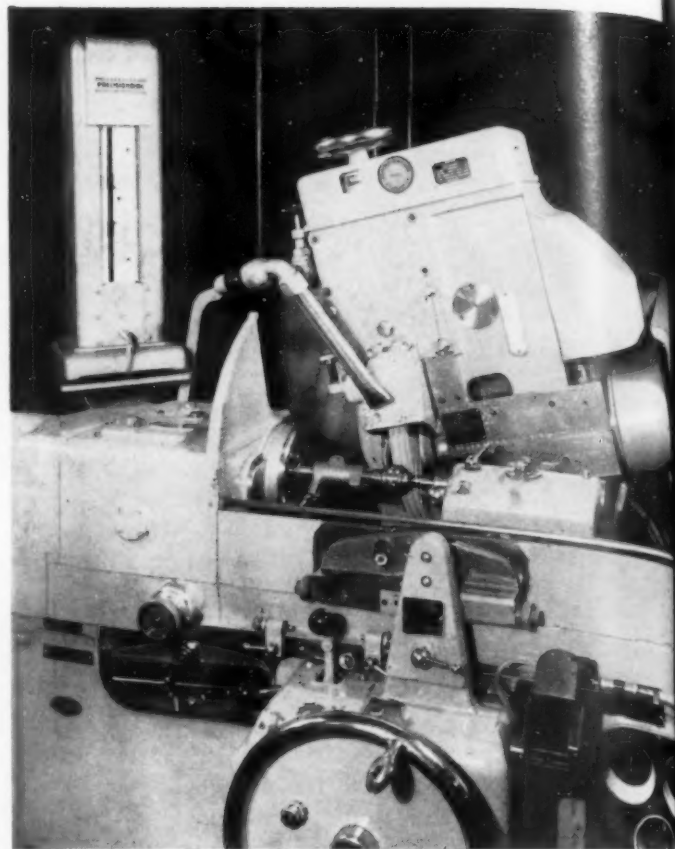
CLOSE-UP VIEW OF DRILL HEADS shows details of operation. Number one head counterbores O-ring seat then actuates head two through a Micro switch. Head two taps a $\frac{3}{4}$ -inch pipe thread and energizes head three in same manner. Multiple drilling and tapping operation by head four is actuated manually. Head five is fed manually for facing operation to complete the cycle.



TOOLS at work

CRUSHFORM GRINDING, producing a triple start ball race track on a power steering component without indexing. The component is ground in one pass to a 0.0005-inch tolerance at the rate of 35 per hour. Radial location of the ball tracks is held in close relationship to drive slot on end of the part by a Sheffield air indicator gage in conjunction with a gaging cartridge and micrometer screw. Table is thus positioned to 0.000025 inch. The table feed is geared to a lead three times the pitch of the grooves.

FOUR facing and turning operations are performed in one setup on jet engine exhaust cone rings on a Lodge & Shipley T-lathe at the Steel Products Div., Firestone Tire & Rubber Co. The work-holding fixture utilizes 12 key-operated clamps to hold the part without distortion. The part, of 321 stainless, is face machined, OD and ID turned and has a contour turned in a floor-to-floor time of 2 hours.



creativity in Design

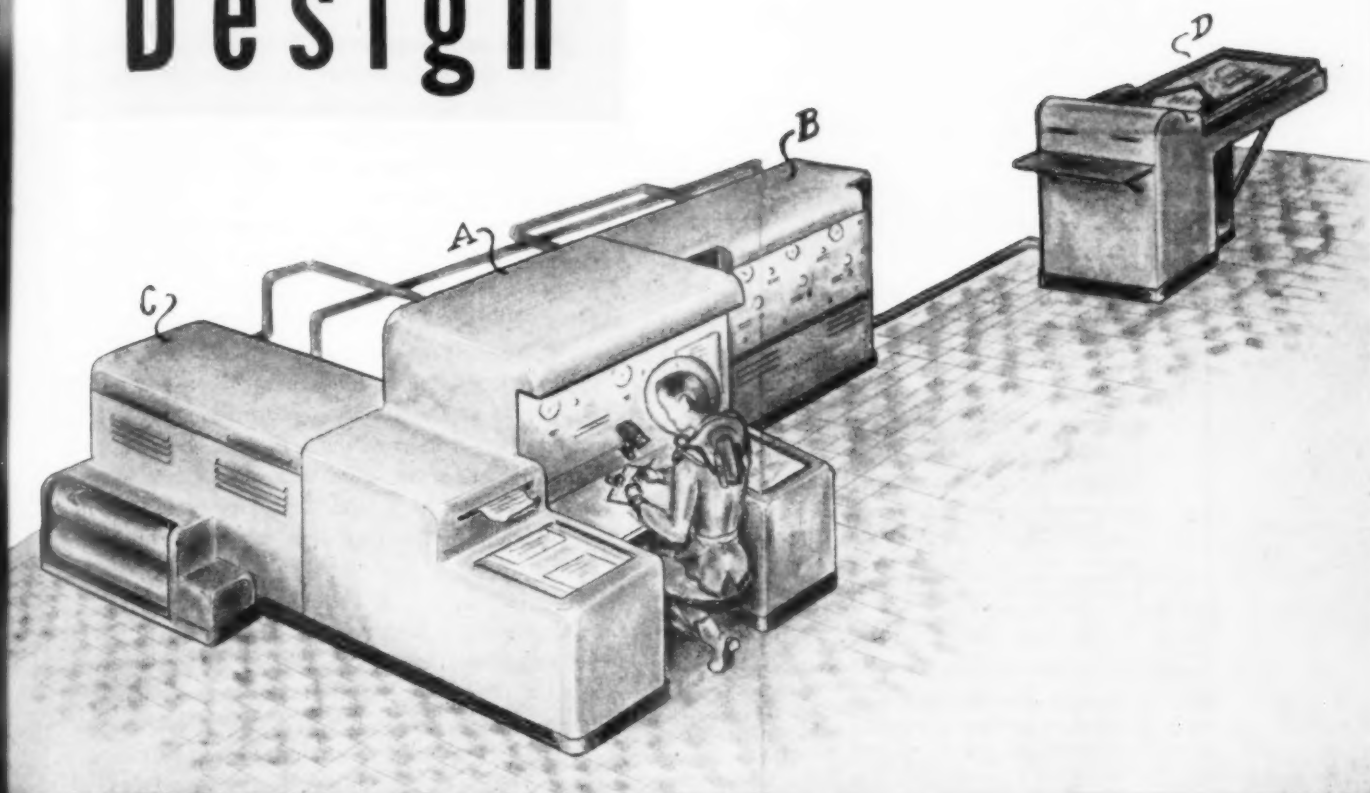


Fig. 1. A theoretical machine-design machine includes a conception unit A, a synthesis unit B, a correlation unit C and delineation unit D.

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THE WIDESPREAD and almost universal discontent that exists between management and engineers as a result of design failures, indicates that the design process should be objectively studied by both engineers and management. Such misunderstanding between technical and nontechnical personnel has existed for a long time and results from the

Abstracted from paper 22T14 "Creativity in Mechanical Design," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

lack of understanding, by nontechnical personnel, of the thought processes required for technical development. If engineers themselves better understood the processes leading to successful technical developments, they could explain the reasons for design failures and much more could be accomplished.

The laymen need not understand the scientific detail that goes on in an engineer's mind. If he knows the logic with which successful development is carried on, the good executive can better direct the technical man's steps toward a successful conclusion.

The design process does not lend itself to the single-step design of complicated mechanisms without "bugs." In fact, it is desirable that mechanisms not be successful the first time so the greatest amount of creativity and ingenuity can be introduced. It is the purpose of this article, therefore, to discuss the logic of machine design and the principles of development to determine and analyze the vital factors that influence success in design.

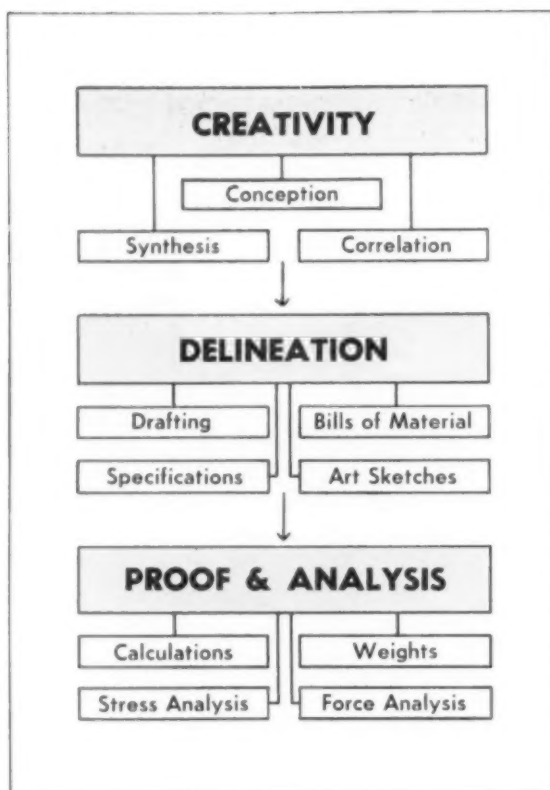


Fig. 2. Design can be broken into three phases, each of which is further subdivided. Creativity must precede delineation, and proof and analysis.

Machine design logic can be evaluated by anyone with common sense whether his background is technical or nontechnical. Many of the problems are psychological. In recent years, there has been a growing effort to approach the design process from human and psychological points of view. The future may see a machine-design machine, Fig. 1, that can take some of the repetition and tedium out of design, but which will be under the control of a human being who will supply the creative force.

Design Process

The required tasks for design and development of a machine can be classified into three categories, Fig. 2. They are shown in the order in which they usually take place in the machine design phase of a project. Considerably more attention has been paid to the second and third operations during both formal education and industrial experience of machine designers and engineers.

Delineation: This task can be defined as that design operation which covers the recording of the design so that it can be efficiently used by manufacturing or sales departments. This class of work

covers those functions normally carried out by the drafting room, such as producing manufacturing drawings, bills of material, specifications, standard sheets, artists' sketches, models, etc.

Proof and Analysis: This task can be defined as that design operation by which the designer analytically checks out the validity of his design. This class of work covers force, weight and stress analysis; calculations; graphical analysis; performance analysis, etc.

Great progress has been made in these two categories and an engineer's education points strongly to them. In the evaluation of a designer at his job, great emphasis is often placed upon his ability to draw or analyze a preconceived design. In fact, the value of creativity has never been recognized, in many quarters, as part of every designer's job. In recent years, however, there have appeared discussions of this phase of a designer's functions and recognition of its value. Also, engineering schools now include courses on this subject in their curricula.

Creativity: If three components of the machine design process are recognized, creativity is seen to provide the raw material for the second and third operations. While delineation and proof-analysis are vitally important, it should be seen that creativity affects the success of a design to an even greater degree.

The popular view of creativity as being a talent some fortunate people are born with is rapidly changing. It is perhaps true that in some people creative tendencies are developed to a greater degree than in others but industry cannot maintain its rate of progress if it must depend only on born inventors or creative designers. If creativity can be analyzed and formalized as have the other two functions, creativeness could then be promoted through education and training.

An interesting analogy can be drawn between designers and musicians. A musician may play one, two or more instruments expertly but still not be able to conduct or compose music. If a musician desires to conduct or compose, he must study the theory of composition, harmony and similar subjects. After such training, and with some experience and natural ability, the musician would then be able to synthesize the functions of many instruments into a single composition.

Analogously, a designer is trained to use the individual technical instruments of drafting, mathematics, stress analysis, kinematics, etc., but he is called upon to compose a machine design without any formal training in the synthesis of all these technical functions into a single design. Much design effort has been wasted because of the lack of

training and experience in the field of composition and creativity.

Creativity Process

As shown in Fig. 2, creativity is broken into three separate functions. The creativity process can be thought of as a closed circuit reaction, Fig. 3. During the design of any machine, this circuit may be circled many times—each time adding input information at each block and removing a portion of the output. Each succeeding circuit is at a slightly higher level to form a three-dimensional spiral closed-circuit between the three functions. During this process, mental and visual aids, in the form of sketches, calculations, models and literature research, may be required. These aids may be used simultaneously at any stage of the creative process. Because of the capacity of the human mind, the entire creative operation may be carried out simultaneously, or perhaps in successive and intermixed overlapping steps, with the other design operation of delineation and analysis.

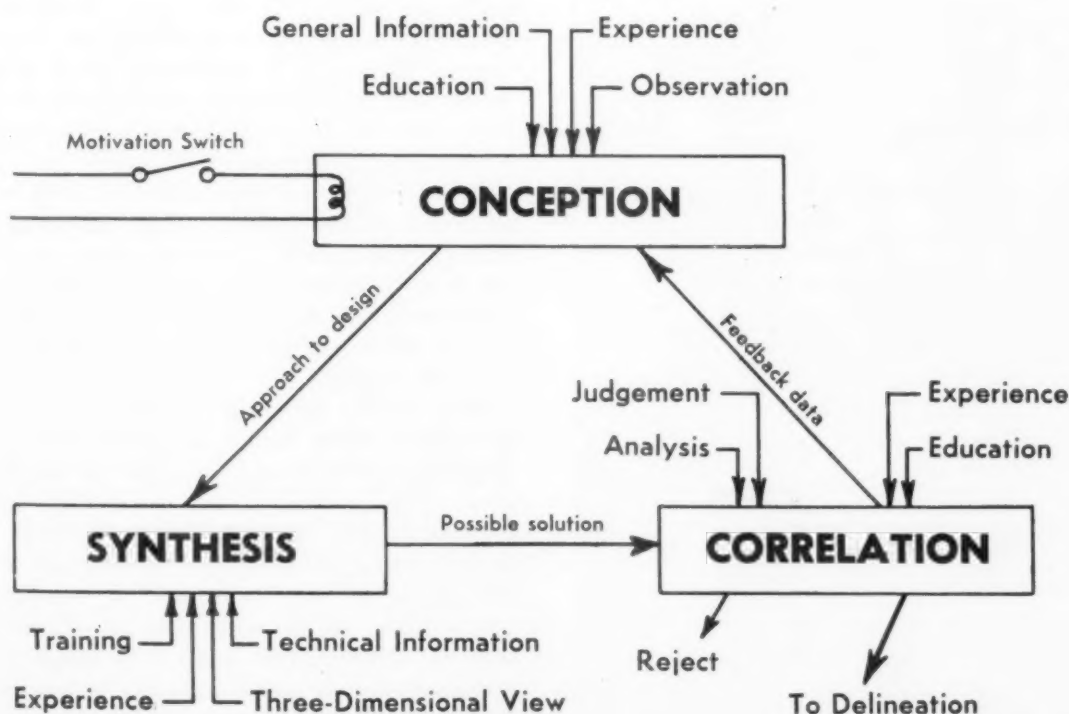
The closed circuit spiral is initially energized by a request from management for a machine to meet specific or general conditions. Subsequently, the circuit is energized by the designer as requirements of the design unfold. In any case, the circuit is set in operation by some external stimulus.

Conception: This function is a review of the requirements and development of an approach to the design of the mechanism for meeting the requirements. After examining all the information available and drawing on his experience, the designer identifies the key factor or factors related to the design. In a sense, the function of the conception step is to condense the general information and the general problem into one or more specific mechanical problems. Some key factors that might be examined during the conception phase of any design are shown in Fig. 4.

Synthesis: Synthesis is accomplished by the designer interpreting the conceived approach in terms of mechanical elements. This function requires a mental building of the mechanism and is often accompanied by sketches, paper models, calculations, laboratory tests, jury rigs, etc. Since, in mechanical design, physical arrangement is highly important, a three-dimensional mental visualization is necessary. (Contrary to the prevalent impression, this is one ability that may be taught and learned.) Synthesis also requires a high degree of familiarity with mechanical elements in all modifications and inversions.

Creative designers eventually evolve their own methods for carrying out the synthesis function, but one suggested method is as follows:

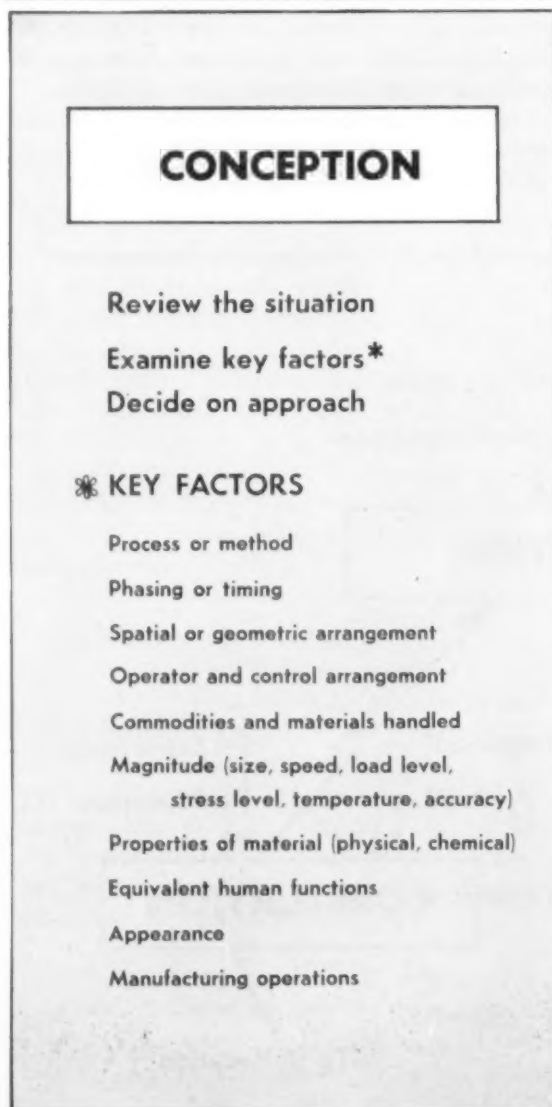
Fig. 3. Creativity can be compared to a closed circuit in which feedback is an important characteristic.



1. Divide the mechanical problems under consideration into separate elements and establish the key mechanical characteristic of each element.
2. Fit each such element to some known mechanical unit, mechanism or part.
3. Combine these mechanical units to produce a new mechanical element that seems to suit the conceived approach.

Correlation: After a mechanical element is synthesized, it must undergo correlation. The correlation function is accomplished by the designer analyzing the synthesized element, testing it in conjunction with other known data relating to the problem and fitting it into the over-all machine problem. At this point, the designer may: (1) discard the synthesized element, (2) retain it for the drafting (delineation) operation or (3) return the new information to the conception stage for a second round on the circuit.

Fig. 4. Conception includes a review of key factors, most of which must be considered in every design problem.



If the element has been wholly or partially discarded as invaluable, the designer will conceive another approach after choosing a new key factor. He will have more information to go on because of his previous circuit. In an actual case, a designer may make this circuit many times before moving up the spiral to the next level.

Feedback is a vital part of this concept. Each time the circuit is completed, even though unsuccessfully, more information relating to the problem is obtained, which increases the chance of success on the next round. To a colleague who had become discouraged after unsuccessfully trying a large number of filaments in his experimental incandescent light bulb, Thomas Edison said something to the effect that they now knew many filaments that wouldn't work which, therefore, increased their chances of finding a successful filament on the next try.

In the design of a complete machine, there is a continual passage around the creativity circuit at each phase of the design. Each circuit must be conditioned by the information developed (ideas both retained and rejected) in all the previous rounds.

Machine Design Machine

The concept of the creativity circuit has an interesting and perhaps frightening implication for future designers. Computing machines can already perform such functions as calculations, memory, comparison, feedback, curve tracing and others performed as part of this circuit. With future progress in computing machines and with advancement of the science of cybernetics, it can be predicted that, to some degree, machines can be designed that can be used to design machines. Such a machine might appear as in Fig. 1.

This machine would have three main components equivalent to the creativity circuit and interconnected in the same way. The net output would be fed to a delineation or drafting machine, which could produce the required manufacturing drawings or code the design information for control of an automatic factory.

Since the end use of all machinery is the satisfaction of a human need, a future man will be required to provide the motivation for the important levels of the creativity circuit spiral. Also, since some information and judgments required in the design process are peculiarly human and non-mechanical, the future man will be required to feed and interpret this information into the design machine. The creativity operation in engineering will always be motivated and controlled by man but it is possible that much of the "design thinking" may be done by future machines.

Welding High-Temperature Materials

By Francis H. Stevenson

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PRODUCTION OF JET-PROPELLED AIRPLANES and guided missiles has introduced new requirements for fabricating metals with high strength at elevated temperatures. Welding and brazing are the only processes which can be used to produce some of the intricate parts used in the manufacture of rockets, rocket components and jet engines. Joints having high strength, comparable to that of the base metal itself, can be achieved by various welding techniques. Fusion and resistance welding processes are both used extensively. The most commonly used fusion welding processes are oxyacetylene, metal arc, submerged arc, inert-gas-shielded metal arc and inert-gas-shielded arc, *Fig. 1*. The most commonly used resistance welding processes for high temperature materials are spot, seam, projection and flash butt welding.

Because high-temperature materials must have good mechanical properties at temperatures of 1200 F and above, the group of suitable alloys is limited. Since tensile strength of a material is closely related to temperature, *Fig. 2*, the designer is forced to choose one which will give the highest strength for the temperature to which it will be subjected. Some of the metals in current use for such applications include the stainless steels of the AISI 300 series; nickel steels; 18-7 PH stainless; super alloys such as Hastelloy A, B, and C; Haynes Alloy No. 25 and titanium.

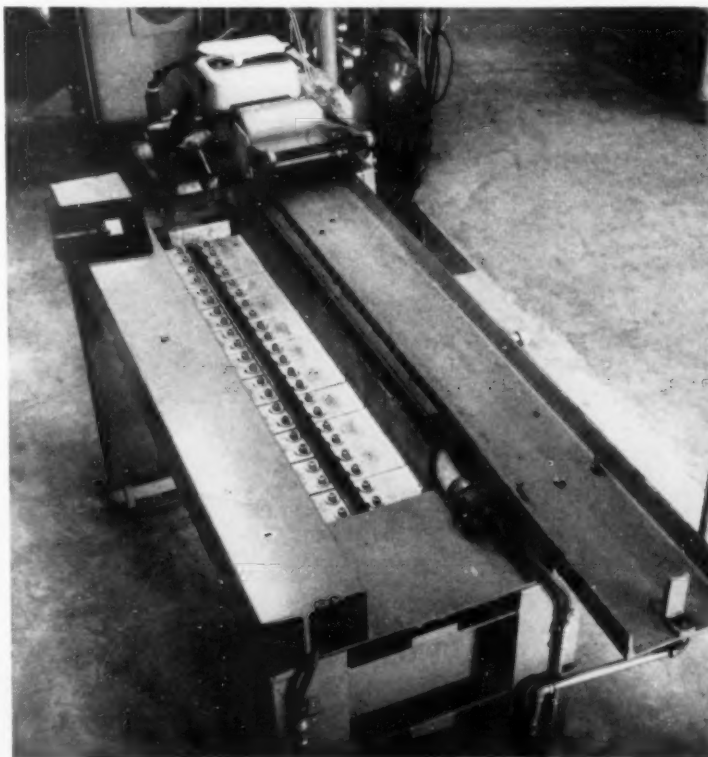
One of the most valuable methods of resistance welding is spotwelding, since most high-temperature materials can be joined by this process. The procedures for spotwelding stainless steels of the 300 series and similar materials are well-known

Abstracted from paper 22T47 "Welding and Brazing of High-Temperature Materials," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

because of their wide use so less familiar materials will therefore be discussed.

Surprisingly, the procedures for spotwelding commercially pure titanium are similar to those used to spotweld Type 317 stainless steel. Illustrated in *Fig. 3* is a spotweld made in Ti-75A titanium sheet under the following conditions: squeeze time 20 cycles, weld time 2 cycles, hold time 20 cycles, net electrode force 500 pounds, transformer setting

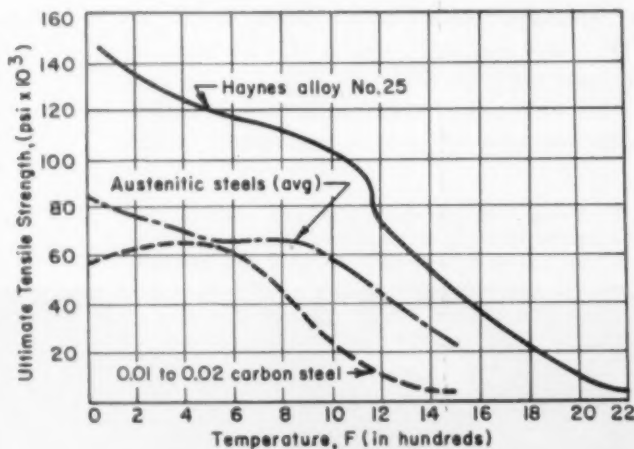
Fig. 1. Setup with fixture in closed position for semiautomatic welding of longitudinal seams in high-temperature parts by inert-gas-shielded arc method.



No. 3, weld heat 80 percent. These conditions gave a shear value of 2200 psi. A spotweld made in Ti-75A titanium sheet under the same conditions, except that the weld heat was 74 percent, resulted in a shear value of 2100 psi. A short welding cycle and high heat were thus found to be desirable for this application. In production, a 4-cycle weld time and a weld heat of 70 percent, other conditions remaining the same, resulted in representative shear strengths of 2300 to 2600 psi.

Titanium alloys such as RC 130A cannot be satisfactorily spotwelded to give adequate strength. When a spotweld is made in this alloy its strength is below that of SAE 1020 carbon steel. Work is being carried on by several research laboratories, however, to find suitable procedures for spotwelding this material.

By contrast tantalum is one of the high-temperature materials which can be spotwelded by special techniques. Resistance-welding experts state that tantalum may be successfully spotwelded under water.



The most widely used fusion-welding process for joining high-temperature materials is the inert-gas-shielded arc. In fact, it is the only process by which many titanium alloys, molybdenum or similar materials may be welded. For this reason the succeeding production techniques discussed will relate to this process. A typical mechanical weld in Type 347 stainless steel is shown in Fig. 4. This weld was made at a torch travel speed of 25 ipm, 125 amperes d-c straight polarity. The edges were butted together and no filler material was added.

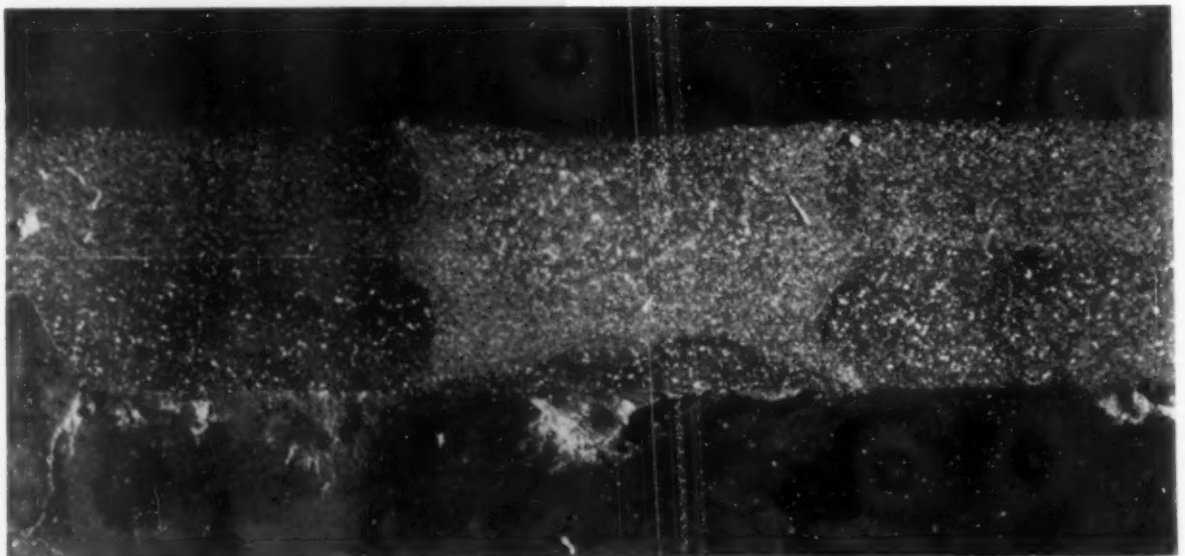
To produce a weld of this quality, control procedures must start with shearing of the material to be welded, because sheared edges must be so true that, when butted together in the welding fixture, no gaps appear. The thinner the material to be welded, the more rigid the control must be at the time of shearing. The same careful control must be maintained throughout the welding cycle. The parts which required this weld were later spun to shape. They were used on a ramjet engine, which illustrates the fact that the weld must be as good as or better than the parent material.

Shielding gases used for such welds are argon and helium. Helium is preferred when welds are made mechanically, because less heat is required and a much narrower weld is possible. Argon, being a cooler gas, is generally preferred for manual welding. Also when thinner materials (approximately 0.010 in.) are welded mechanically, argon is generally preferred.

The welding of Haynes No. 25 alloy is similar to that of Type 347 stainless steel except that shrinkage is a little greater. The weld zone affected

Fig. 2. (left) Relationship of ultimate tensile strength of various alloys to temperature. The austenitic steel curve shown is the average of the group.

Fig. 3. (below) Spotweld in Ti-75A titanium sheet made at 80 percent heat.



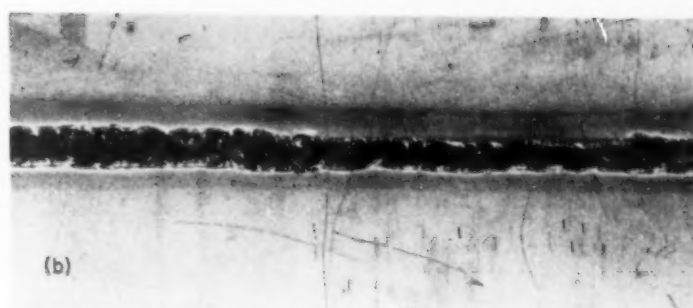


Fig. 4. Typical inert-gas shielded arc weld produced on 347 stainless sheet using mechanical methods; (a) view from torch side, (b) view from back of weld.

by heat must be kept as small as possible or small surface cracks will appear. If stress corrosion tends to be a factor in the design, all welds of this material should be annealed. The same process has been successfully used for titanium alloys. Data on butt welds in 0.063-inch Ti-75A titanium sheet are summarized in TABLE 1.

Tooling and Fixtures

Commercially pure titanium can be welded with the present-day standard equipment if care is taken to shield the weld properly. This means that any fixtures designed for welding titanium must be provided with a means of introducing shielding gas to the underside of the weld. In addition, tooling is needed to keep parts in position during the welding to help dissipate heat and produce identical parts.

The accuracy demanded in welded parts calls for the best in a welding fixture. Sometimes it can be simple and inexpensive, or it may cost many thou-

sands of dollars. A simple, inexpensive and effective fixture, such as shown in Fig. 5, can be used to provide a chill plate to control the heat-affected area. At the same time this supports the boss as well as shields the underside of the weld. This fixture can be made from scrap material and a minimum amount of tool design time is required.

The back-up bar is one of the most important parts of a fixture of the type shown in Fig. 1, because it controls depth and contour of the weld penetration as well as rate of cooling of the weld. When this kind of fixture is built for experimental shop work the back-up bar should be removable so it can be changed for various jobs. Whether the fixture is used for experimental work or on production, a means of chilling or heating the bar should be provided. The principal difference between back-up bars is the width and depth of the groove. Whether the bar will be used for flat sheet or cylindrical shape influences the design.

A welding fixture with several stations is shown in Fig. 6. The first station is preheating. The part

Table 1—Data on Inert-Gas Tungsten-Arc Butt Welds. In 0.063 in. Titanium Alloy Ti 75A Sheet, Using Thoriated Tungsten Electrode

	Specimen					
	A	B	C	D	E	F
Filler Wire	None	None	Ti-75A	Ti-75A	None	None
Wire Diameter, in.	—	—	0.062	0.062	—	—
Current, dc, amp	100	100	100	100	50	50
Arc Voltage	—	—	—	—	13	13
Electrode Dia., in.	1/16	1/16	1/16	1/16	1/16	1/16
Inert Gas (Argon or Helium)	A	A	A	A	He	He
Torch Side (Cu ft/hr)	30	30	25	25	25	25
Backup Side (Cu ft/hr)	10	30	10	None	10	10
Manual or Automatic	A	A	M	M	A	A
Carriage Speed, ft/min	20	18	—	—	19	19
Ultimate Strength of weld, psi	75,500	73,600	77,600	75,600	77,700	74,300
Elongation in inches, weld joint, %	16.9	16.6	16.4	15.9	18.0	16.5

Fig. 5. Simple weld fixture designed with chill plate.





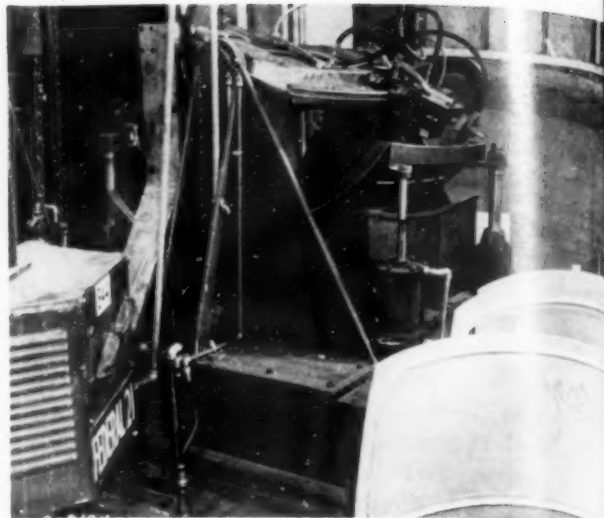
—Photo courtesy Airline Welding & Engineering Co.

Fig. 6. Multistation welding fixture with automatic indexing timed to the welding operation.

is rotated under the preheating torch in preparation for welding in the second station. At station two a submerged-arc process is performed; station three is for loading and unloading; while station four is an inert-gas-shield welding operation.

An important item sometimes overlooked by tool designers in designing fixtures for spotwelding is the use of nonmagnetic materials, particularly when part of the fixture must be in the throat of the machine during welding. If a magnetic material such as a carbon steel is used in the fixture, an induction current is set up in the fixture, reducing the heat available for the spotweld. This in turn makes necessary an upward adjustment of the current supplied to the electrodes and places an unnecessary load on the spotwelder. Therefore, the bulk of the fixture should be fabricated from a nonmagnetic material such as aluminum. Magnetic material should be used only where unavoidable.

In Fig. 7 is shown a type of spotwelding fixture in which the operator moves the spotwelding gun to the desired location for making the spot. Since this fixture is in reality a spotwelding machine



—Photo courtesy Lockheed Aircraft Corp.

Fig. 7. Special spotwelding fixture for use with movable gun.

without the usual throat, use of magnetic materials is practical.

Only a few of the many types of fixtures have been illustrated but the requirements for fixtures may be summarized as follows:

1. Accessibility: This is of prime importance if a good job is expected from the operator.
2. Quick action clamping instead of screws: This means that a fixture can be loaded and unloaded in minimum time. These two types are illustrated in Figs. 8 and 9. Both fixtures are readily accessible and can be rotated so that the welder is working in a down-hand position.
3. Allowance for shrinkage: In general, uniformity of the welding procedure is the best way to control shrinkage. This applies to manual as well as mechanical welding. Fixtures may be shimmed at the part pickup points, however, to permit easy determination of the best final location by means of tool trial.

References

1. *Steels for Elevated Temperature Service*, published by United States Steel Co.
2. *Haynes Alloys for High Temperature Service*, published by Union Carbide and Carbon Corp.

Fig. 8. Fixture for downhand welding positions.

—Photo courtesy Lockheed Aircraft Corp.

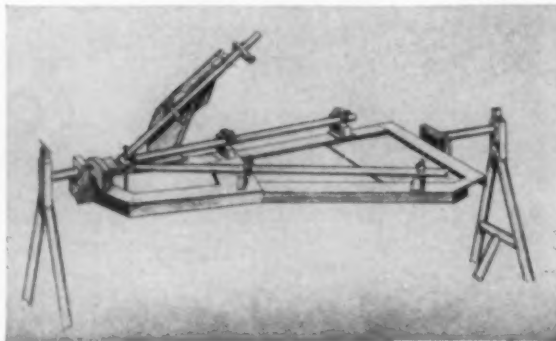
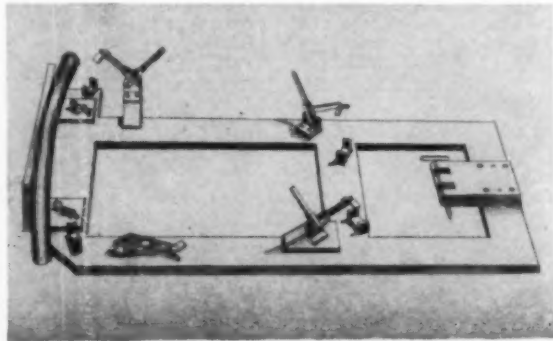


Fig. 9. Fixture with quick acting holding clamps.

—Photo courtesy Lockheed Aircraft Corp.



high-speed HOBBING

... proved practical in extensive tests

By J. W. Rapp

Supt. of Gear Manufacturing
Ohio Axle & Gear Div.
Rockwell Spring & Axle Co.
Newark, Ohio

GEAR HOBBING PRODUCTION can be increased by 100 to 150 percent without additional equipment, manpower, tool cost or tool maintenance. The extensive research and test data that are presented in this article support this statement and prove beyond a doubt that gear hobbing at high speeds well up in the so-called carbide range, is entirely feasible. These speeds can be achieved with standard hobs and machines now in use.

Data and facts presented are the result of three years of concentrated research at Allison Division of General Motors Corp. and the Ohio Axle and Gear Division of Rockwell Spring and Axle Co.

Until recently, except for plastics and other soft materials, a speed of 125 to 150 surface feet per minute was considered maximum for good tool life. Increased production was obtained by the use of multiple-thread hobs, which have proved satisfactory for roughing, pregrinding and preshaving operations. These tools represented an increase in tool cost, however, and a decrease in surface finish and accuracy of the gear hobbled.

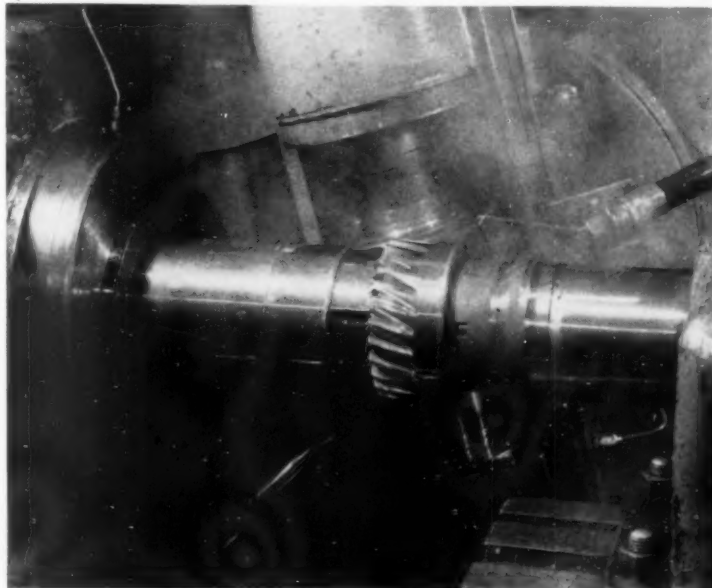
The initial tests run at the Allison plant were started with a normal feed of 0.040 inch per revolution. Speed tests showed the most effective speed to be around 275 surface feet per minute. At this speed, equal tool life was obtained at both 0.040 ipr

and between 0.090 and 0.100 ipr feed, with a very noticeable decrease in tool life between these figures, and also above 0.100 ipr. Results of these tests have already been published.

Effects of Speed and Feed

Using the arrangement shown in Fig. 1, feed and speed tests were run on a helical transfer gear, which has the following characteristics: 26 teeth; 5.162 normal diametral pitch; $17\frac{1}{2}$ degree normal pressure angle; $17\frac{1}{2}$ degree right-hand helix angle; 5.283 pitch diameter; $2\frac{1}{2}$ -inch face width. The steel was SAE 94B17, normalized with a hardness range of 135 to 175 Brinell. One gear was run per load, leaving 0.008 to 0.010 inch over balls for shaving stock. The hobs used were 5 x 5 x 2 single-thread, accurate unground.

Fig. 1. Hobbing a helical gear in a test setup at 500 sfm (400 rpm), 0.090 ipr feed. Floor-to-floor time is 3 min 45 sec. Finish produced is excellent. Lead variation is held within 0.001 inch over length of the teeth.



Abstracted from paper 22T32-1, "Hobbing Gears at High-Speed," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from the Society Headquarters.

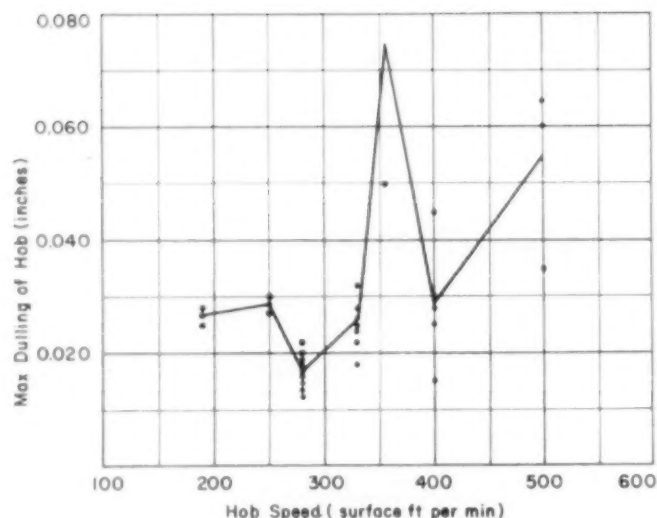


Fig. 2. (top left) Relation of surface speed to hob dulling. Feed is 0.090 ipr, gears cut per grind is constant at 40.

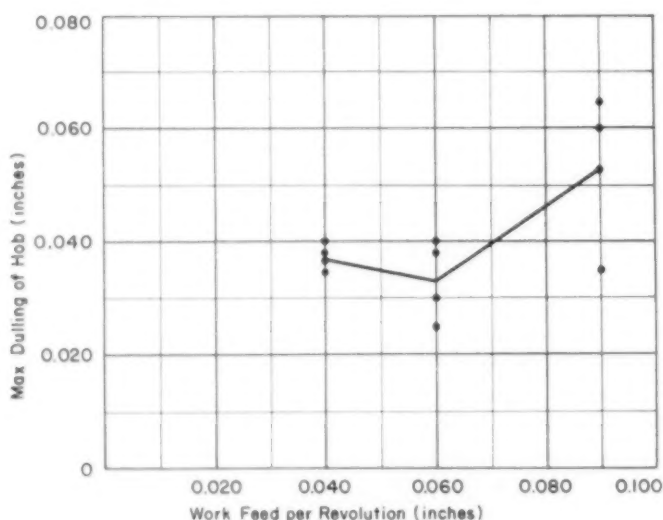


Fig. 3. (lower left) Relation of feed rate to hob dulling. Hob speed is 500 sfm; 40 gears cut per grind.

from the dullest tooth on the hob.

In analyzing the condition of the increased dulling obtained as the hob progressed across from start to finish, it was noted coolant temperature started at about 70 F and increased rapidly to approximately 120 F after only about an hour of cutting.

Coolant Temperature and Pressure

A setup was made to permit cooling the coolant and tests were run to determine the effect. Conclusions drawn from this test are as follows:

1. Coolant temperatures up to the maximum reached of 120 F have no appreciable effect on hob life.
2. The only benefit received from the cooler temperature was a noticeable reduction in smoke, which would improve working conditions somewhat.
3. Some benefit may be derived from the cooler temperature in precision work, because closer size control could be maintained.

To determine the effect of high pressure coolant application a series of tests was run varying the pressure from 100 to 600 psi. Maximum results were obtained at around 225 psi. Most of the improvement noted was obtained at 100 psi, with a slight continuing improvement to 225 psi. Results obtained are compared in Fig. 4 with those given by usual coolant pressure.

Tests were run on a hand-shift, hob head, vertical type hobbing machine. The feed was held constant at 0.100 ipr and the maximum hob dulling at 0.025 inch. The hob was shifted one full tooth whenever the row of teeth in use reached that amount of dulling. The spur gear under test had the following specifications: 31 teeth, 6 diametral pitch, 25-degree pressure angle, 1 1/4-inch face width, 8620 steel, core treated to 20-25 Rc, and was preshave hobbled in one cut. These tests indicate that:

1. At least 50 percent increase in tool life can be obtained at any range of speed by the application of the coolant at pressures from 100 to 225 psi.
2. Gears cuts are considerably cooler and a closer size control is possible.

Rake Angle vs. Tool Life

A few years ago, one of the leading hob manufacturers made some tests on the effect of varying degrees of positive rake angles on hob life. These tests were limited, but did indicate that the same tool

The chartered data in Fig. 2 were derived from these tests, holding all factors such as coolant, hob condition, blank accuracy and blank material as constant as possible. Conclusions drawn from this test are as follows:

1. The maximum tool life was obtained at approximately 280 sfm.
2. The same tool life was obtained at 330 sfm as at 188 sfm.
3. As the speed was increased, surface finish and accuracy of involute profile improved.

Next it was decided to investigate the effect of feed variations while running with the speed held constant at 500 sfm. While this speed was excessive for good tool life at any feed, the best results were obtained at 0.060-inch feed per revolution of the work. As shown in Fig. 3, the hobs tested averaged 0.033-in. wear. In every case, the amount of dulling on the first half of the hob was decidedly less than on the second half. The recorded dulling was taken

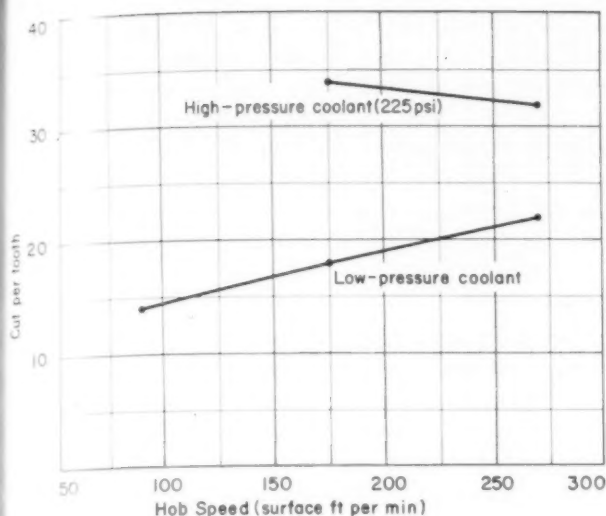


Fig. 4. Comparison of hobbing with high and low pressure coolant. Feed is 0.10 ipr. Maximum dulling of hob is measured at 0.025 inch.

last one, which may have entered into the results obtained.

Conclusions reached are as follows:

1. Light feeds such as 0.040 ipr, with hook angles in the 27 to 30-degree range allow speeds up to 350 sfm without excessive tool wear.
2. Due to the design of the hob, only 10 gashes were allowed. As results of the tests with standard hobs were obtained with hobs having 12 gashes, it follows that further improvement would come by having 12 gashes in the experimental hob also. Therefore, a new design is being worked out in order to provide 12 gashes.
3. Tests should be continued on the following basis: vary the feed from 0.040 to 0.090 ipr, the speed from 280 to 500 sfm, and hold the hook angles constant at 24, 27 and 30 degrees.
4. Indications point to a noticeable improvement in the higher hook angle range. Continued research is being carried on along this line.

Machine Rigidity

One of the high-speed tests involves a vertical type gear hobber, Fig. 7, which cuts 6 gears per load at 265 sfm. The gears have 33 teeth, 3.6421 normal diametral pitch, 0.498-inch whole depth,

life could be obtained in the speed range of 60 to 150 sfm by increasing the rake angle as the speed was increased. Study of these results showed the same tool life was obtained at the following speeds and rake angles: 60 sfm with 0-degree rake, 105 sfm with 8-degree rake angle, and 150 sfm with 20-degree positive rake angle.

By projecting these results into the 300 to 500 sfm range, it appeared logical that even higher rake angles would result in increased tool life just as they did in the lower speed range. With this in mind, a special hob was designed and manufactured with a 30-degree positive rake angle. Since the process of manufacturing such a job accurately is complex, several months was required to produce it.

Previous tests indicated that a 30-degree positive rake angle would not be efficient under 200 sfm, so it was decided to start the initial runs at 500 sfm with a feed of 0.040 ipr. The light feed was chosen because precautions were necessary to prevent breakage of the hob. This speed and feed also allowed the comparison between the 0-degree rake angle used in compiling results charted in Fig. 3, and the 30-degree rake angle.

Fig. 5 shows an experimental hob, a gear and some chips produced by this hob running at 500 sfm speed and 0.060 ipr feed. The formation of the chip is decidedly different from that normally found in hobbing. The chip shows the effect of high shearing action brought about by the 30-degree positive hook angle on the hob. It should also be mentioned that at no time was any discoloration of the chips obtained.

In studying the data plotted in Fig. 6, it appears that the lighter feeds produce the best results. Due to limitations of the hob grinding machine, however, the maximum hook angle which could be maintained was 27 degrees. During the eight regrinds as charted, the angle progressed from 27 degrees on the first regrind to 24 degrees on the

Fig. 5. Gear produced in hobbing tests and experimental hob used.



23-degree, 45-min. left-hand helix angle, are made from SAE 94B17 steel normalized to 135-175 Brinell, 9.900 pitch diameter. They are preshave hobbed in one cut, leaving an average of 0.010 in. over balls for shaving. Twenty-four gears are cut per hob grind, with a maximum stock removal in hob sharpening of 0.020 inch. The hob used is a 5 x 5 x 2 inch class B ground, preshave, single thread.

Trouble has been experienced with the finish of the gear teeth and this machine is being run on an

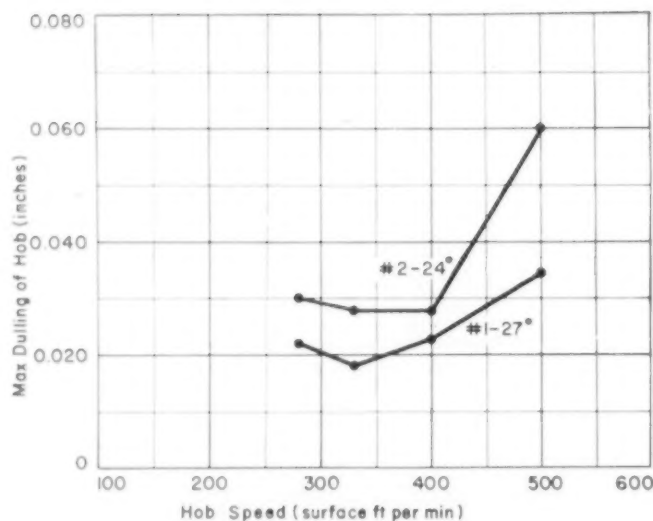


Fig. 6. (above) Relation of dulling to hob speed at high rake angles. Hob No. 1 has 27-degree positive hook, used with 0.040 ipr feed. Hob No. 2 has 24-degree positive hook, used with 0.060 ipr feed.

Fig. 7. (below) Vertical gear hobber cutting load of 6 gears at 265 sfm (210 rpm). Feed is 0.040 ipr and floor-to-floor time per load is 50 minutes.

experimental basis only. The problem is to provide enough rigidity in the machine, mainly the hob head in order to overcome chatter.

Enough tests have been run to prove that the heavier pitches, such as 3 and 4, can be hobbled at the same surface speed as the finer pitches without excessive tool wear. All of the machines in regular production on this job are running at 165 sfm hob speed. A program was started at once to overcome the lack of rigidity in the machine, working in conjunction with the machine manufacturer.

Summary

The controlling factor in determining hob life is the rapid breaking down of the corners of the hob teeth. In normal hobbing operations, the entering life of the hob.

In the initial speed runs, it was rather surprising that in the range of 300 to 600 sfm, the corner breakdown was predominantly on the leaving edge of the hob tooth. Another angle of approach was then taken and an analysis of all test runs made at speeds from 80 to 600 sfm, the corner breakdown progressed from a fast rate on the entering edge at 80 sfm, to a fast breakdown on the leaving edge at 600 sfm. It seemed obvious that the best tool life would be obtained at a speed where the corner breakdown would be distributed between the entering and leaving edges. This definitely proved to be true.

In these hundreds of tests a great variety of steels, hardness and pitches were observed and checked for tool wear. The following statements can be made, based upon results:

1. Any low-carbon steel, such as SAE 8620, 4620, 6120 and 1115, with a hardness under 225 Brinell, can be hobbled at speeds of 275 to 300 sfm and feeds of 0.090 to 0.100 ipr, with excellent tool life and quality.
2. The limiting factor in hobbing the heavier pitches is not the tool wear, but the hobbing machines themselves.
3. High coolant temperature, while being objectionable because of smoke produced and greater difficulty in controlling size because of heat expansion, is not a contributing factor in hob wear.
4. High-pressure coolant application will result in greatly improved tool life if the process can be developed to a practical standpoint.
5. Relatively small changes in speed can affect hob life greatly, especially above 300 sfm.
6. Climb hobbing in almost every instance results in greater tool life and improved surface finish.
7. The development of a high positive angle hob allows speeds between 300 and 350 sfm which, with light feeds such as 0.040 ipr, will produce gears having a high degree of accuracy and surface finish.

Thus these tests and the data derived from them prove that higher hobbing speeds are entirely practicable and will result in greatly increased gear production.

machining Titanium

a report of developments

By G. T. Fraser

Rem-Cru Titanium, Inc.
Midland, Pa.

NO OTHER METAL has had as rapid development as titanium. It is being rapidly accepted by industry for increased uses and the tonnage going into production parts is increasing. Enthusiasm is especially great in the aircraft industry because of the metal's unusual characteristics. Although about 40 percent lighter than steel, it is comparable to steel in structural strength. Resistance to corrosion is equal to or better than 18-8 stainless steel in most media.

Titanium's physical make-up sets it apart from other metals. Comparisons are good only to a limited degree, and could cause incorrect generalizations. Carbon solubility is about 0.20 percent. Alloys containing between zero and 0.20-percent carbon have machining characteristics similar to titanium. More carbon produces hard carbides which reduce tool life markedly.

The seizing tendency and rate of work hardening of titanium necessitates generous depth of cuts to prevent riding of tools on the work, with resulting excessive tool wear. Low thermal conductivity and a tendency to gall make necessary adequate coolants, slow speeds and heavy cuts. Hard coatings of titanium oxide and nitride are produced at temperatures above 1200 F during forging and must be removed before machining. Because the metal has a low modulus of elasticity (15×10^6), small diameter bars must be backed up to prevent springing during machining.

Procedures and techniques for machining common metals cannot be applied to titanium because a correlation does not exist between hardness and physical property strength. Commercial and pure

grades are stringy and tough, making machining difficult.

Turning: Sturdy machines and tools are necessary to eliminate tool chatter during turning operations. Machines must be capable of maintaining uniform, positive cutting feeds and speeds. High-speed steel tools have been found more satisfactory than carbides. Titanium tends to build up and chip the cutting edges of carbide tools. Experiments with carbide, however indicate tools suitable for cast iron have less chippage.

Back rake angles of 10 to 15 degrees are recommended. A combined side and back rake produces a uniform chip flow. Negative rakes are only effective for intermittent cutting. Chip breakers are practical because titanium chips are brittle and not too ductile. Tendencies to smear make necessary tool relief angles of at least 8 degrees. The accompanying table offers a guide for tool angles and machine setting.

Tools used for the rough turning of forgings or hot rolled bar stock should have a lead angle to break the oxide skin in advance of the cutting edge. For best results, the initial cut should be started at a relatively slow speed and heavy feed. Surface speed should then be increased and feed reduced.

Drilling: A slow speed and steady, positive feed are essential to prevent work hardening in the bottom of drilled holes. Best results have been achieved with a standard 59-degree cutting angle (30-degree helix) at 12 to 15 sfm with a feed of 0.003 to 0.008 inch per revolution. A short, heavy-duty drill is recommended to prevent springing and breakage. Air and electric drills can be used if they have speed reducers to conform with the slow, steady speed required.

Unless deep holes are kept free of chips, recutting of them will dull the drill. Variations of feed will also dull the drill and cause a condition similar

Abstracted from paper 22T36, "What is Known Today about Machining Titanium," presented at the 22nd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

Tool Angles and Machine Settings for Turning Titanium
(for single point tools)

Tool Material*	Rough Turning		Finish Turning		
	Commercially Pure		Alloy	Commercially Pure	Alloy
	A, B	C, D	C	C, D	C, D
Feed (min.), ipr	0.030-0.050	0.015	0.012	0.008	0.008
Speed, sfm	20-30	40-65	30-65	150-350	150-300
Lead Angle (SCEA), deg	15-20	15-20	15-20	10-20	10-15
Side Rake (positive), deg	8	4	6	4-6	4-6
Clearance Angle (relief), deg	7-8	7-8	6	6	6
Nose Radius (minimum), in.	1/32	1/32	1/32	1/16	1/16

*Identification of tools:

A: 18-4-4 High-Speed Steel

B: 18-4-1 8% Co High-Speed Steel

C: C-3 (light finishing) or C-4 (precision boring) Carbide

D: C-1 (Roughing Cut) or C-2 (general purpose) Carbide

Note: Carbide grades are Carbide industry Standard Code for nonferrous materials.

to work hardening in stainless steel. Experience has shown that a gun drill should be used for exceptionally deep holes.

Tapping: Efforts are being made by tap manufacturers to develop taps suitable for titanium. Two fluted, spiral taps are now recommended for holes up to $\frac{3}{8}$ inch. Three flutes are most effective for larger holes.

Without the use of carbon tetrachloride, or a similar cutting fluid, taps often freeze in the hole because of a tendency for titanium to smear over the tap land. Tapping speeds should not exceed 12 to 15 sfm.

Reaming: Although standard carbide reamers have been used in production operations at 100 to 200 sfm, it is suggested that holes be reamed initially at 40 to 70 sfm. Feeds should be 0.008 to 0.020 inch per revolution, increasing with the diameter. Spiral fluted reamers produce a smooth finish on titanium.

Milling: High-speed steel cutters have proved more successful than other types for milling titanium. Climb milling is recommended because it permits the cutter to leave the work with a fine chip. This technique also lessens chippage resulting from heavy build-up at the cutting edge. Feeds less than 0.004 inch per cutter tooth cause smearing and cutter speed should be 25 to 35 sfm.

Relief angle of 10 to 12 degrees is recommended with other relative angles being positive in the range of 6 to 10 degrees. Cast alloy cutters have been used satisfactorily at 50 to 75 sfm; carbide cutters, 65 to 120 sfm. The oxide skin on bar stock and forgings should be removed to insure longer tool life.

Broaching: Proper broach design is essential for machining titanium. Each tooth should take a chip load of 0.005 inch. Teeth ground with a positive rake and full gullet enable the chip to curl freely. The relief angle should not exceed 5 degrees to prevent galling and seizure. Because sharp corners cannot be held in titanium, they should not be used in broach design. Segmented carbide tipped broaches used at relatively slow speeds with a CO₂ coolant have proved successful.

Sawing: Three to four pitch power hacksaw blades can be used to cut titanium. The ideal feed is approximately 0.010 to 0.015 inch per stroke. Speeds should range between 25 to 35 fpm, with adequate coolant to flush away chips. Oxide on forged or hot rolled bars should be ground off before sawing.

Band sawing is practical for stock $\frac{1}{2}$ -inch thick or less. Since the development of effective cutoff wheels, frictional sawing is now practical.

Grinding: Abrasive engineers have improved grinding methods. During the past two years, ratios between wheel and metal wear have progressed from 1:1 to 1:6. Some internal grinding ratios are as high as 1:50. Quality of finish and semifinish operations for ID and OD machines is continually being improved. There has been little progress in snag and form grinding techniques.

Aluminum oxide wheels are generally considered more effective than green silicon carbide wheels. Wheel manufacturers should be contacted for specific problems.

Forging: Machining of titanium has been performed primarily on titanium forgings. Forging

temperatures are somewhat lower than those for steel: 1650 to 1800 F for heavy reductions of large sections and for closed die or contour forgings; 1300 to 1550 F for lighter reductions. Titanium should not be allowed to soak at the forging temperature.

Mechanical properties of forgings are comparable to those of the wrought material. An efficient method for producing large forged disks is on a press or by roll-forging. Titanium requires more draft and fuller fillets than steel.

Control of the final reduction will permit the use of cold working in the lower temperature range (1300 to 1350 F) for obtaining higher physical properties in the finished forging.

Coolants: An ideal coolant has not been developed. Water mixed with a five-percent solution of sodium nitrite (NaNO_2) is currently used. Sulphurized cutting oils are effective for general machining. Pressure must be strong enough to wash away all chips.

Sheet Fabrication: Forming characteristics of annealed, commercially pure titanium sheet is comparable to $\frac{1}{4}$ -hard stainless steel. Alloy sheets are similar to forming $\frac{1}{2}$ -hard stainless steel. Commercially pure titanium cold forms reasonably well at 800 F. More pressure and slower speeds are necessary than for cold forming low carbon steel. Multiple stage operations require interstage annealing at 1075 F for 15 min. Alloy sheets hot form well at 800 to 1000 F; higher temperatures cause oxides difficult to remove by pickling.

Power brakes, power shears and punches and dies used for stainless steel are satisfactory for titanium. Spinning of commercially pure types is easily done at 800 F. The metal will not spin cold.

Rubber-Pad Forming: Uniform pressures of 2500 to 5000 psi and slow speeds are needed for forming operations. Gages more than 0.040 inch should be formed at 800 to 1000 F. Steel form blocks or Kirksite dies with hard steel inserts are best.

Since conventional rubber press pads are usually too soft, rubber throw pads of high Shore durometer hardness should be used. Powdered asbestos sprinkled on hot blanks protects the throw pads during hot forming.

An average flange spring-back for hot formed commercially pure titanium sheet is 5 deg; 8 deg for cold formed; alloy sheet, 9 and 12 deg. If a wiper ring is used, optimum clearance should be at least stock thickness plus 10 percent. A smaller clearance causes galling. Radius on the forming draw ring should be about 8T. Compression wrinkles can be worked out by hand at 400 to 500 F.

Stretching: Commercially pure and alloy sheets can be cold stretched. Sheets should be initially stressed to about its yield strength and formed slowly at an even pressure. The piece should be held on the die for about 30 seconds before pressure is released. Clamping jaws must uniformly grip the section being formed.

Drawing: Commercially pure titanium sheet can be deep drawn at 800 F. Major difficulties are caused by a lack of suitable lubricants. Drawing of 0.050-inch material 2x4x4 inches deep can be done in one operation without wrinkling.

The high production costs of titanium have somewhat restricted its use to military applications. Constant experimentation and development efforts being presently carried out should make possible universal nondefense use in the future.

Semiautomatic Broaching

BROACHING AT THE RATE of 480 pieces per hour is being accomplished with a semiautomatic machine featuring two adjustable stationary insert-type broaches. Parts involved are three different sizes of automotive bearing caps which must be broached on the locating faces.

Performing this work is a 4-ton unit made by Colonial Broach Co., having a 12-inch broaching stroke traveling at the rate of 30 fpm. Of particular interest is the fixture design of this machine: rather than clamping the part in the usual way, it guides the bearing cap as it is pushed past the

stationary broaching teeth by the ram. Three caps of different sizes are machined on the unit while using the same fixture—two are broached as the fixture supports them in a straddling manner, then the fixture is inverted and in that position performs mechanical guiding function for the third bearing cap with the greatest thickness.

The entire operation serves to point out the effectiveness of integrating design, development, and manufacturing of machines, broaching tools, fixtures and automatic methods into a single program to improve a mass production job.

properties of Titanium Bolts

By R. A. Baughman

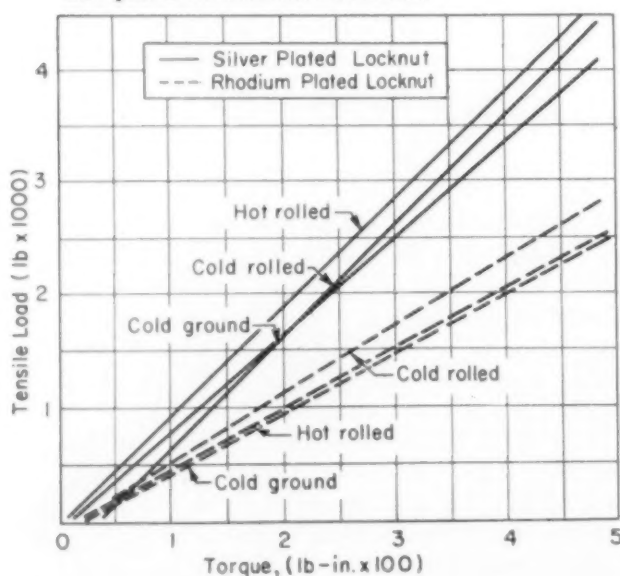
Aircraft Gas Turbine Div.
General Electric Co.
Cincinnati, Ohio

SINCE TITANIUM has become available, its use for bolts has appeared desirable from a weight-strength standpoint. Titanium, however, has been reported to have a high degree of relaxation, and a tendency to seize and gall other materials. Tests were recently conducted on RC 130B titanium bolts to determine if they could be used on gas turbines and give a satisfactory service life.

A series of tests was made on $\frac{7}{16}$ "-20 bolts with hot rolled threads, annealed and sandblasted; cold rolled threads, stress relieved, and cold ground threads. These bolts were used with silver plated and rhodium plated austenitic stainless steel locknuts.

Tensile: Standard tensile tests were run on one of each type of bolt at room temperature and 500 F. Results of these tests showed that tensile strengths of bolts compare favorably with that of the original material, as listed in the table. Roll threaded bolts were slightly superior at both temperatures but more tests might have reduced the variation. All fractures occurred in the threaded section and were ductile in nature.

Plot of torque applied and tensile load resulting for various combinations of unlubricated titanium bolts and plated stainless steel locknuts.



Torque-Tensile: For equal torques, a much higher tensile load is obtained with silver plated nuts as shown in the curves. This indicates a higher friction between rhodium and titanium. Tensile loads for equivalent torque were greatly increased for all combinations by use of a high-temperature lubricant containing colloidal graphite.

Galling: One of each bolt and nut combination was tested through ten cycles of load, heat and unload. In almost every test there was a greater tendency toward galling between the bolts and silver plated nuts. The break-away torque was much higher for this combination; being highest for bolts with ground threads. These results were not anticipated because of the higher friction indicated for rhodium in the torque-tensile tests.

Mechanical wear, as shown by reduction in bolt thread diameter, was not completely significant but was greater with rhodium plated nuts. This was expected because of the greater friction indicated for this combination.

Because of the higher friction of rhodium, thread loading on these combinations was not as high as with the silver because they were torqued equally. It can be concluded that if the rhodium combinations were torqued higher, wear could be excessive.

Relaxation: Titanium bolts of the three thread types were combined only with silver plated nuts for relaxation tests. Under relatively low stresses, up to 5000 lb, there is little if any relaxation after 150 hours. At higher stresses (near bolt yield point) relaxation is high in shorter periods.

These tests have indicated that satisfactory service life can be anticipated for correctly applied titanium bolts. All things considered, silver plated nuts appear to have an advantage, the best results being obtained with combinations of silver plated nuts and rolled bolt threads.

Tensile Test Results on Titanium Bolts

Type Thread	Temperature	Tensile Load (lb)	Strength* (psi)
Original Material	Room	150,000
Cold Rolled	Room	17,080	156,700
Cold Ground	Room	16,980	155,800
Hot Rolled	Room	17,080	156,700
Original Material	500F	120,000
Cold Rolled	500F	14,060	129,000
Cold Ground	500F	13,180	120,900
Hot Rolled	500F	14,160	129,900

*Based on thread root diameter of 0.3725 inch.

recommended clearances for copper brazing

By the Standards Committee

ASTE Mid-Hudson Chapter

THIS TABLE has been compiled from the results of brazes in a hydrogen atmosphere using unalloyed copper paste and wire with brazing temperature of 2050 F. All brazes were made in accordance with good industrial practices. In general, the tighter the fit, the stronger the resultant brazed joint. It should be noted, however, that limits assigned to pins and holes with diameters less than $\frac{1}{2}$ inch result in a range of fits in which clearance will be maxi-

mum or interference will be minimum. The reason for this is to reduce the possibility of distortion of delicate parts when assembling components prior to the brazing operation.

Values in the table should be considered as nominal for average application. In some instances, limits other than those shown in the table must be used, depending on such factors as part design, volume of metal, etc.

Table of Clearances

Hole Diameter (inches)	Pin Diameter (inches)	Limits Fit		Approximate Joint Shear Strength Copper Wire		Copper Paste	
		Clearance (inch)	Interference (inch)	Minimum (psi)	Maximum (psi)	Minimum (psi)	Maximum (psi)
+0.001 0.1245—0.000	+0.0000 0.125 —0.0015	0.002	0.0005	14,000	26,500	22,500	28,000
+0.001 0.187 —0.000	+0.0000 0.1875—0.0015	0.002	0.0005	14,000	26,500	22,500	28,000
+0.001 0.2495—0.000	+0.0000 0.250 —0.0015	0.002	0.0005	14,000	26,500	22,500	28,000
+0.001 0.3115—0.000	+0.0000 0.3125—0.0015	0.0015	0.001	14,500	28,000	23,000	28,000
+0.001 0.3735—0.000	+0.0000 0.375 —0.0015	0.001	0.0015	15,000	28,000	23,000	28,000
+0.001 0.436 —0.000	+0.0000 0.4375—0.0015	0.001	0.0015	15,000	28,000	23,000	28,000
+0.001 0.4975—0.000	+0.0000 0.500 —0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.560 —0.000	+0.0000 0.5625—0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.6225—0.000	+0.0000 0.625 —0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.685 —0.000	+0.0000 0.6875—0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.7475—0.000	+0.0000 0.750 —0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.810 —0.000	+0.0000 0.8125—0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.001 0.8725—0.000	+0.0000 0.875 —0.0015	0.000	0.0025	21,000	28,000	25,000	28,000

Table of Clearances (Continued)

Hole Diameter (inches)	Pin Diameter (inches)	Limits Fit		Approximate Joint Shear Strength Copper Wire		Copper Paste	
		Clearance (inch)	Interference (inch)	Minimum (psi)	Maximum (psi)	Minimum (psi)	Maximum (psi)
+0.001 0.935 -0.000	+0.0000 0.9375 -0.0015	0.000	0.0025	21,000	28,000	25,000	28,000
+0.0015 0.997 -0.0000	+0.0000 1.000 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.122 -0.0000	+0.0000 1.125 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.1845 -0.0000	+0.0000 1.1875 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.247 -0.0000	+0.0000 1.250 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.3095 -0.0000	+0.0000 1.3125 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.372 -0.0000	+0.0000 1.375 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.4345 -0.0000	+0.0000 1.4375 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.497 -0.0000	+0.0000 1.500 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.5595 -0.0000	+0.0000 1.5625 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.622 -0.0000	+0.0000 1.625 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.6845 -0.0000	+0.0000 1.6875 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.747 -0.0000	+0.0000 1.750 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.8095 -0.0000	+0.0000 1.8125 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.872 -0.0000	+0.0000 1.875 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.9345 -0.0000	+0.0000 1.9375 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 1.997 -0.0000	+0.0000 2.000 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 2.122 -0.0000	+0.0000 2.125 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
+0.0015 2.1845 -0.0000	+0.0000 2.1875 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
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-0.0015 2.4345 -0.0000	-0.0000 2.4375 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000
-0.0015 2.497 -0.0000	-0.0000 2.500 -0.0015	0.000	0.003	21,000	28,000	25,000	28,000



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Joseph P. Crosby

President, 1954-1955

THE AMERICAN SOCIETY OF TOOL ENGINEERS

Elected to ASTE's highest office at the 1954 Annual Meeting held in Philadelphia, Joseph P. Crosby is the new president of the American Society of Tool Engineers. He will also serve as chairman of the Board of Directors for the year.

Mr. Crosby, vice president and a director of Lapointe Machine Tool Co., Hudson, Mass., is a member of the Boston ASTE chapter. He has travelled extensively in the interest of the Society, visiting chapters throughout the United States and Canada, and in 1952 was official representative for ASTE at the Machine Tool Show at Olympia in London.

A registered professional engineer in Massachusetts, Mr. Crosby is a member of the National Machine Tool Builders Association, Engineering Society of New England, The Lexington Club of Boston, and Scituate Yacht Club.

Now completing his third term as a member of the ASTE Board of Directors, he has also served as second and first vice president. He has headed Boston chapter's standards and education committees and has held the posts of second and first vice chairman as well as chapter chairman.

Mr. Crosby was graduated in 1928 from Harvard University where he played football for three years and was a member of the Varsity Club. He was mentioned for All-American in 1925.

A resident of Lexington, Mass., he is active in community affairs and at present is a member of the Lexington High School Building Committee. He is married and a father of two children. His daughter attends the Convent of the Sacred Heart and his son the Wharton School of Business at the University of Pennsylvania.

Board Elects New Officers for ASTE;

Delegates Name Directors for 1954-55

Headed by Joseph P. Crosby as national president, a new slate of Society officers was elected April 29 at the annual meeting of the Board of Directors. Serving the 30,000 members of ASTE are: Dr. H. B. Osborn, Jr., Cleveland chapter, first vice president; H. C. McMillen, Evansville chapter, as second vice president; and H. E. Collins, Houston chapter, as third vice president.



A. B. Clark



J. O. Horne



C. M. Smillie

New Directors of ASTE

Dr. Osborn is technical director of Tocco Division of Ohio Crankshaft Co. Mr. McMillen is plant manager for the Bedford, Ind., plant of Philco Corp. Mr. Collins is manager of the process engineering department of Hughes Tool Co.

R. C. W. Peterson of the Toledo chapter was elected treasurer. He is president and owner of Peterson Engineering Co. Wayne Ewing, partner of the Arrowsmith Tool and Die Co. and member of the Los Angeles chapter, was elected secretary. Harold D. Long, Chicago ASTE member and president of Scully Jones and Co., was elected assistant secretary-treasurer.

Directors were named by the House of Delegates which held its meeting on April 28. Only one ballot was required to elect the members of the 1954-55 Board who will take office at the semi-annual meeting to be held next October in Detroit.

New directors elected include: A. B. Clark, Cleveland ASTE chapter, technical consultant for Haynes-Stellite Co.; C. M. Smillie, Detroit chapter, president of C. M. Smillie & Co.; J. O. Horne of J. O. Horne & Co. and member of the Rochester chapter; and Mr. Long and Mr. Ewing.

Re-elected to the Board of Directors were: Willis Ehrhardt, St. Louis chapter, Ehrhardt Tool and Machine Co.; G. A. Goodwin, Dayton chapter, chief process engineer, Master Electric Co.; B. J. Hazewinkel, Los Angeles chapter, president of Daily Grinding, Inc.; G. A. Rogers, Montreal chapter, sales engineer, Rudel Machinery Co., Ltd.; R. A. Smith, Hartford chapter, chief tool engineer, Pratt & Whitney Division.

Messrs. Crosby, Collins, McMillen and Osborn were also re-elected to serve on the board.

Also voted for by the House of Delegates were an honorary membership in ASTE for Senator William Purtell and 11 life memberships for the founders of the Society who have not received previous recognition.

Recipients of the life memberships are: Messrs. C. C. Buckner, E. Deluiz, R. H. Farmer, W. Fors, F. L. Hoffman, A. H. Hoffman, C. S. Horn, F. H. Hartlep, W. L. Newton, E. Rutt and H. T. Johnson.

The petition for Senator Purtell's honorary membership was submitted by the Hartford, Fairfield County and New Haven chapters. Members of the Detroit chapter submitted the petition for the life memberships.



At the annual meeting of the Board of Directors, clockwise from left foreground, are: Wayne Ewing, Raymond C. W. Peterson, Gerald A. Rodgers, Howard C. McMillen, Willis G. Ehrardt, Leslie B. Bellamy, Joseph P. Crosby, Roger F. Waindle, Harry E. Conrad, George A. Goodwin, Ben J. Hazewinkel, Dr. Harry B. Osborn, Jr., Harold E. Collins and Richard A. Smith. Seated at the back table: Nancy Morgan, Jeanne Broniman, Fay LaRue, Allan Ray Putnam, and Ray H. Morris, who is parliamentarian for the Board of Directors.

Roger Waindle installed the new officer group at the 22nd Annual Membership Banquet. Taking the oath of office, from left: Messrs. Crosby, Osborn, McMillen, Collins, Peterson, Ewing and Long.

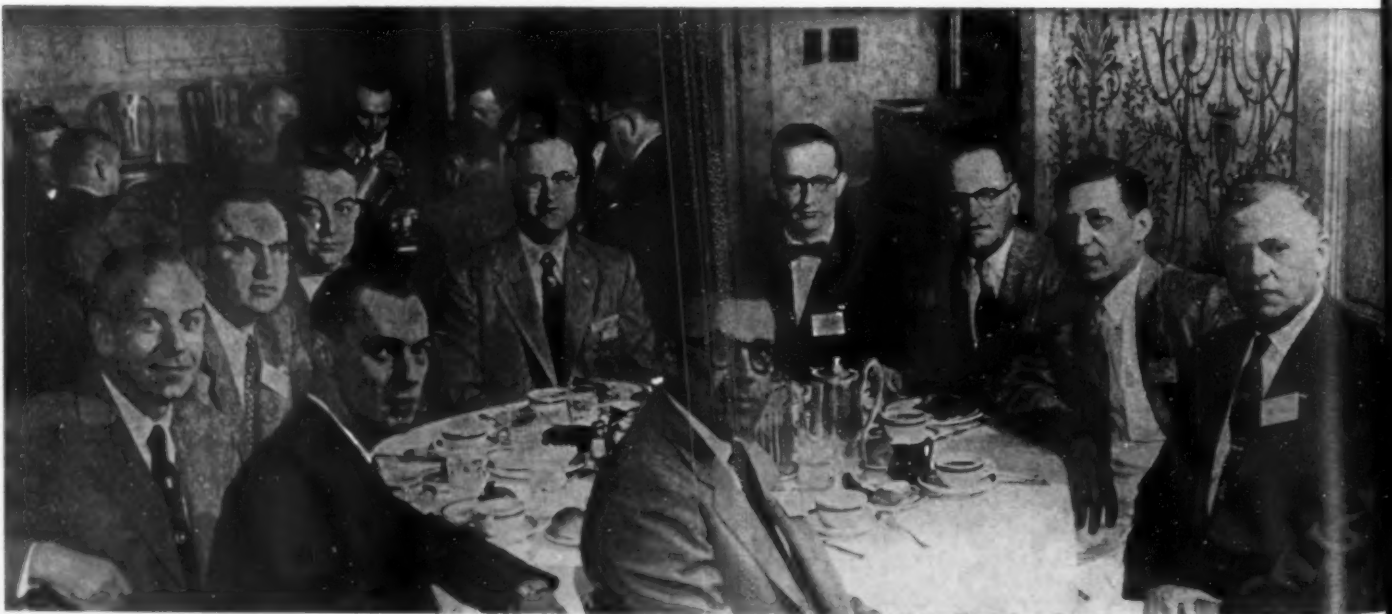


national delegates' **BREAKFAST**

The president's breakfast launched activities for national delegates the day they held their meeting to elect ASTE's new Board of Directors.

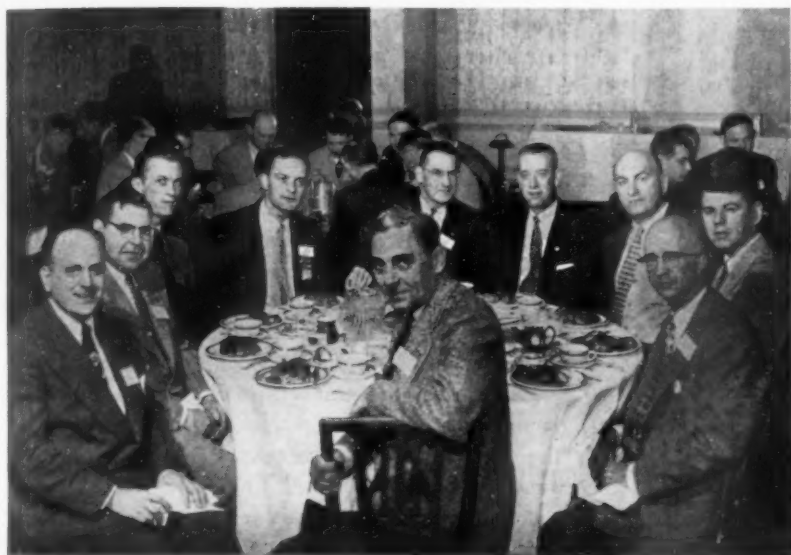


These chapter representatives were joined by Howard C. McMillen, fifth from right, now second vice president.





National officers at this table included, from left: Harold E. Collins, now third vice president; Joseph F. Crosby, national president; and Willis G. Ehrhardt, who was elected to serve another term on the Board of Directors.



Seated with these delegates are Joseph L. Petz, chairman of the National Editorial Committee, and James O. Horne, who was elected to the Board.

This group of delegates was joined by George A. Goodwin, far left, who was re-elected to the Board, and Wayne Ewing, far right, national secretary and also a member of the 1954-55 ASTE Board of Directors.



Expansion of Educational Facilities

Urged by ASTE Banquet Speaker

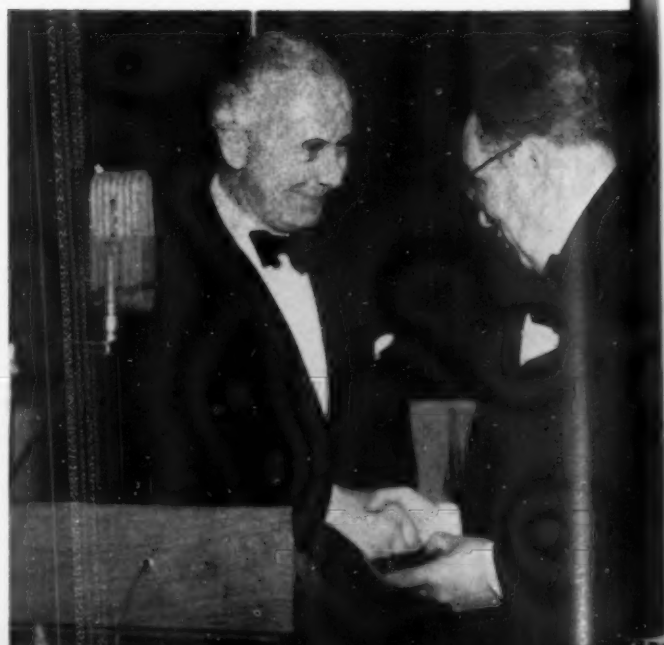


Dr. David D. Henry, right, addresses the banquet audience on the pressing needs for increased educational services in America. On his right is pictured Roger F. Waindle, immediate past president.

Citizens who regard the educational needs of youth as "postponable" would destroy the source of their nation's strength for the long international struggle ahead, Dr. David D. Henry, executive vice chancellor of New York University, declared at ASTE's 22nd Annual Membership Meeting and Banquet.

Speaking to an audience of more than 900 at the Bellevue-Stratford Hotel, Dr. Henry called attention to reported Russian successes in building scientific and technical capability through education. He said that concern in America about maintaining armament superiority needs to be supplemented with attention to the maintenance of educational superiority.

While increasing numbers of Russians are being given educational opportunities, Dr. Henry said "the elementary and secondary schools in this country are confronted with financial strangulation. In a few years the demands for school service, because of increase in population will overwhelm us.



Executive Secretary Harry Conrad, right, thanks Sir Walter Puckey for the silver letter opener presented to him as a gift from the Institution of Production Engineers, London, England.

Children who will be calling for these services are now born. But we still answer the question with complacency and conferences instead of appropriate action."

Describing the accomplishments of higher education as "likewise far short of our capacity, needs, and faith," Dr. Henry stated that the nation's colleges face the future with inadequate numbers of staff, inadequately paid during a time of severe competition for their services, and with inadequate facilities.

"At every institution, the physical facilities are less than enough to do the job for students who are now there," he said, "and in every community there are inadequate offerings for people of different abilities and interests."

"Unless every American youth is given the opportunity to develop his talents and his intellectual horizons," Dr. Henry said, "we shall lose our sense of adventure, our aspiration for improved society, our faith in individual freedom."

"We shall go down the road of cynicism, and content ourselves with the conservation of what we have, with security as our watchword and mediocrity our standards."

A standing ovation was given Dr. Henry after his address. The former president of Detroit's Wayne University spoke in place of Dr. Henry T. Heald, chancellor of New York University, who was unable to attend because of a death in his family.

Another banquet highlight was the presentation of two honorary memberships in ASTE. The first,

voted on by this year's House of Delegates, was given to the Honorable William A. Purtell, United States Senator from Connecticut. Ray H. Morris, past president of ASTE, made the presentation.

The second honorary membership was given by Mr. Waindle to Sir Walter Puckey, president of the Institution of Production Engineers, London, England. Just as the president of the American Society of Tool Engineers is made an honorary member of the Institution of Production Engineers for his term of office, so its president becomes an honorary member of ASTE during his tenure.

Toastmaster for the banquet program was Harry E. Conrad, executive secretary of ASTE. Retiring President Waindle installed the newly-elected Society officers. The invocation was delivered by Chaplain F. L. Albert of the United States Navy.

Roger Waindle, right, and Joseph Crosby congratulate Senator Purtell who was honored by ASTE for his outstanding industrial achievements.



Wives of national officers present at the banquet, from lower left, included: Mesdames H. C. McMillen, J. X. Ryneska, L. B. Bellamy, Wayne Ewing, H. B. Osborn, Jr., R. B. Douglas, R. C. W. Peterson, J. P. Crosby, Larry Doyle and R. F. Waindle.



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Banquet Candid's

Upon joining the ranks of past presidents, Roger F. Waindle, left, received his life membership in ASTE from Joseph P. Crosby, newly-installed president.

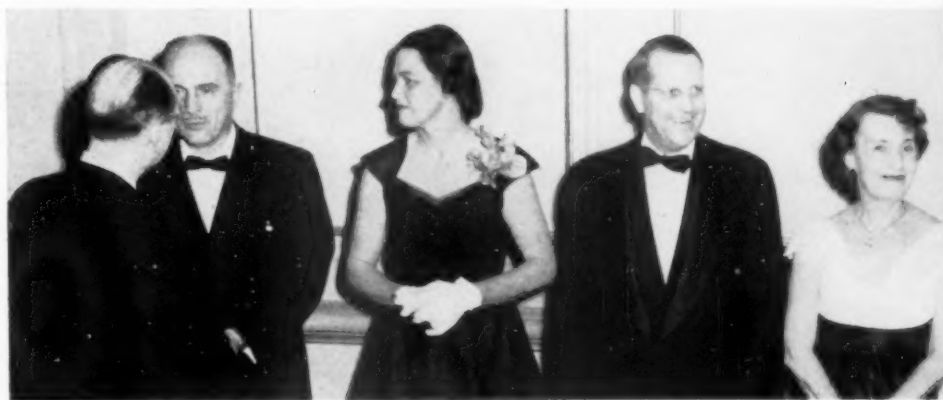
National committee chairmen who served during 1953-54 sat together at a special table. From left: Larry Doyle, Professional Engineering; Kenneth W. Riddle, Program; Arthur R. Diamond, Education; George F. Bryan, Standards; F. J. Sehn, Book; John X. Ryneska, Constitution; Joseph L. Petz, Editorial; and Edward H. Ruder, Public Relations.



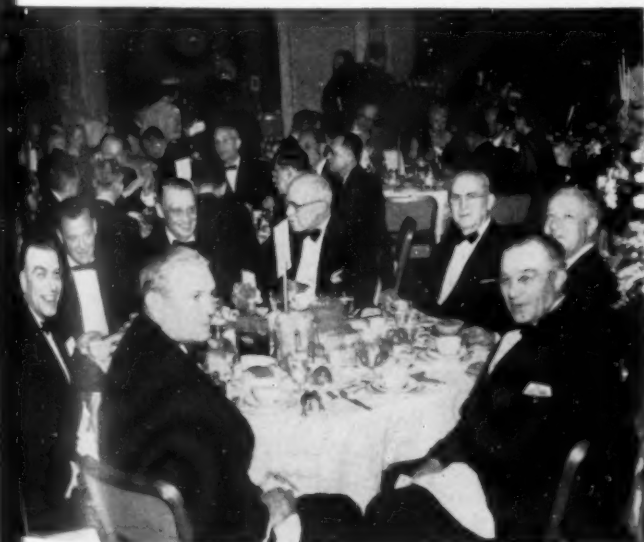


Entertainment by the Fortnightly Club, 45-voice chorus, was much enjoyed by the large banquet audience.

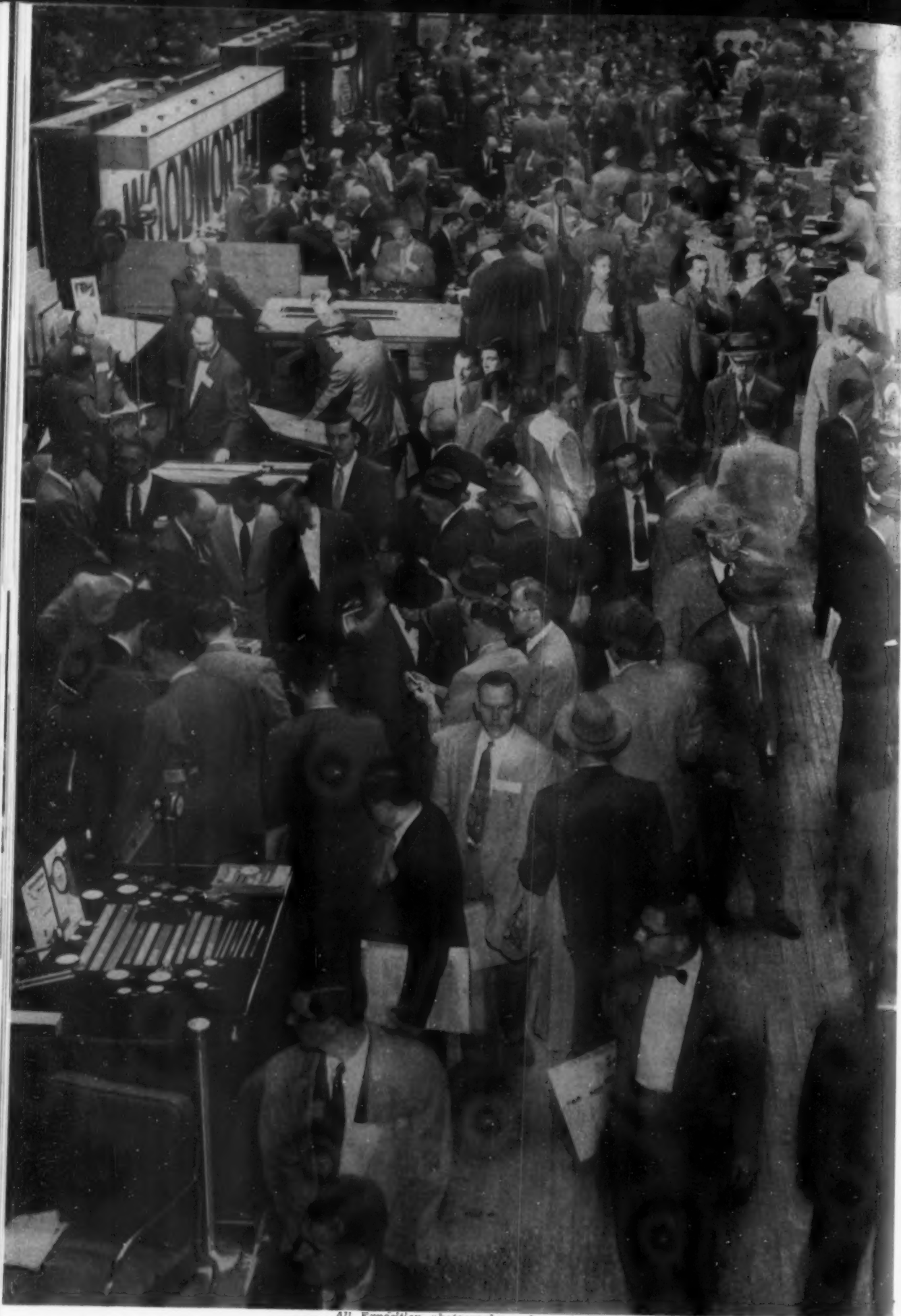
At the president's reception which preceded the banquet, Mr. and Mrs. Roger Waindle greet Dr. David D. Henry, who delivered the banquet address. Next in the receiving line are Mr. and Mrs. Joseph Crosby.



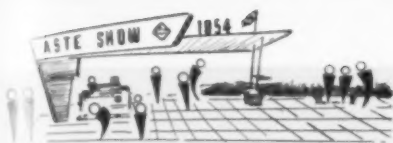
Past presidents at the banquet, clock-wise from left foreground, included: Ray H. Morris, Robert B. Douglas, Walter F. Wagner, T. Bert Carpenter, William H. Smila, Frank W. Curtis, I. F. Holland, A. B. Clark (table-hopping chairman of the 1953-54 Membership Committee, and J. J. Demuth.



Editorial contest winners Donald Cox, Lima, Ohio, and Sara T. Moxley, Long Island, pose with National Editorial Chairman Joseph L. Petz at a reception held in their honor at Philadelphia.



All Exposition photographs, unless otherwise noted, by Lens-Art Photographers, Detroit.



ASTE's Largest Exposition

With nearly 500 exhibits to see, the thousands of ASTE visitors who attended the Industrial Exposition in Philadelphia were acutely aware it was the largest ever held by the American Society of Tool Engineers.

A total of 160,655 square feet was utilized to show the latest in cutting tools, machine tools and their accessories, inspection equipment, presses and the newest developments in workholding and other devices.

Attendance figures place the total registration for the week at 28,746. Most of these visitors found the exposition entirely too big to be covered in one day and made return trips to Convention Center.

When Mrs. Albert M. Greenfield, chairman of the Board of Trade in Philadelphia, cut the ribbon Monday morning to officially open the 1954 Exposition, hundreds of visitors were already lined up in the main lobby waiting to get into the exhibition halls.

Many new services were available to the convention goer. He was given a carry-all envelope to hold the literature picked up at exhibits. The envelope featured a complete list of exhibitors and booth numbers as a handy reference. He could look up old acquaintances by checking the complete registration roster which was prepared every night by special IBM equipment.

The ASTE Center provided booths where he could inquire about chapter questions involving the many Society activities. He could also leave messages at the ASTE Center for those persons he wanted to contact.

Any questions that could not be immediately answered at the center were filed on a specially prepared blank to receive the attention of National Headquarters after the convention. Plant tour registration and banquet tickets were also available there. A lounge area provided comfortable chairs for the weary ones to sit down and rest tired feet.

Transportation to Convention Center was facilitated by shuttle busses which ran every 20 minutes.

Taxicabs came and went in a steady stream, operating at full capacity.

For the first time, a special preview showing at the Exposition was held Sunday afternoon for the ASTE national officers, members of the host chapter at Philadelphia and their families, who were invited to browse about the halls leisurely and stop for refreshments at the ASTE Center. The event drew an attendance of more than 1200.

Technical sessions attracted many of the men attending the Exposition. A total of 6,249 attended the industrial conferences, panel discussions and paper presentations by industrial experts. Peak attendance was enjoyed at this year's conferences, with several programs boasting 'standing room only' audiences.

Exposition Week was officially underway when Mrs. Albert M. Greenfield cut the ribbon at the entrance to Precision Hall. ASTE national officers gave her a hand, from left, Dr. Harry B. Osborn, Jr.; Joseph P. Crosby; Roger F. Waindle; and Harold E. Collins.



industrial exposition

Waiting to get into the exhibit halls, these ASTE convention-goers glance over the floor plans.



All available registration booths were in operation and workers bent every effort to speed up the "signing up" process for the thousands of engineers who attended this 1954 Exposition.





A group pauses to watch a flame-hardening machine at the Cincinnati Milling Machine Co. exhibit.



Engineers stop to ask questions about the precision boring machines and heads displayed at this booth.

Men interested in aircraft parts and the tooling used to produce them, stop at this booth to check the latest developments.



A demonstration by the Charles Bruning Co. personnel of a circle drawing machine used for pectoral drawing attracts a large crowd of interested spectators.

A typical booth scene shows men viewing processes and tools, discussing manufacturing problems and exchanging knowledge and ideas.





A question from the audience gets an answer from the panel on "Production Planning and Control."

Discussing their program on automation, from left, are: H. A. Oldenkamp, J. H. Billings (standing), L. S. Strauss and D. E. Hawkinson.



Last-minute details get the attention of N. M. Perris, C. E. Verkler, Emil Kitzman and Edward Stachel.



TECHNICAL SESSIONS

draw record crowds

The broad range of industrial topics covered at ASTE technical sessions held during exposition week attracted a record attendance of 6,249 persons. Several programs were presented before 'standing room only' audiences, with peak attendance at a single session reaching the 580 mark.

Planning of the technical meetings began months in advance. The finalized program of 49 papers and five panel discussions represented hundreds of hours of work by the technical sessions committee, the national headquarters staff, and all of the participating speakers.

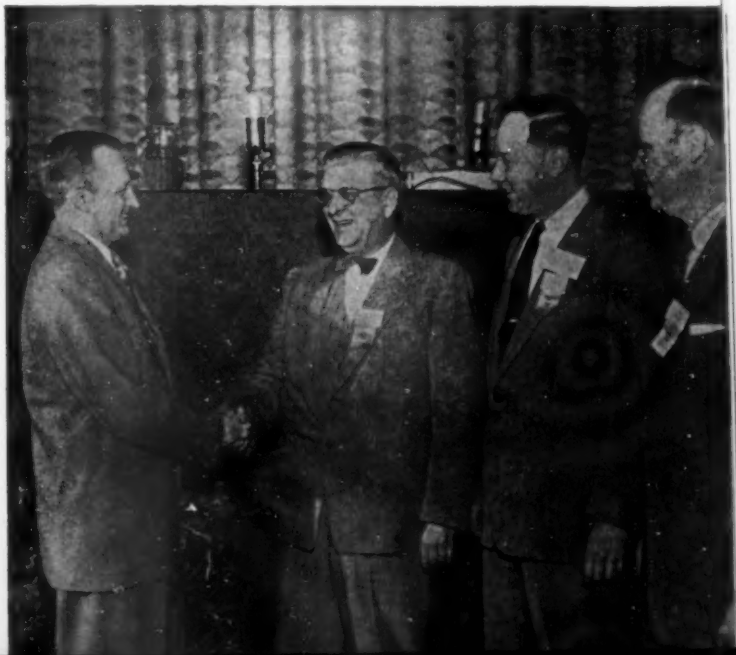
Copies of all papers are now available from ASTE national headquarters. A charge of \$.50 is made for each one ordered and quantities of four or more can be had for \$.25 each. Summaries of the panel discussions will be available after July 1.

A session outline is checked by H. R. Murphy, Russell Yaw (standing), W. L. Tann and J. R. Weaver.



Moderator Richard Robertson congratulates J. S. Brozek. With them are E. L. Ketter and John Prohashka.

More good wishes are extended by Mr. Robertson to J. L. Anderson, A. R. Sparrow and T. H. Olson.



technical sessions



All participants in the industrial conferences attended briefing sessions to iron out the many details of giving a smooth-running presentation. Leaving their particular meeting are: from left, J. W. Rapp, Moderator Granger Davenport, and J. P. Aloisio.

Speakers R. S. Segsworth, P. N. Sorenson and Moderator Albrecht, from left, have just received certificates of appreciation after a successful technical session.

These panel members met to discuss improved milling practices. Standing: T. G. Vickers, E. J. Krabacher and W. A. Coe. Seated: Dr. Horace Frommelt, K. B. Kaiser, J. R. Roubik, the session moderator and Jess Daugherty.





An evening panel discussion gets underway as Moderator Charles Thomas starts proceedings with an opening statement. The main speakers are: from left, Dr. R. F. Pearse and E. M. Dowd. Also participating in the discussion were: from left, K. K. Rauch, L. S. Paulsen, R. C. W. Peterson, and G. C. Bennett.



On stage and ready for a technical session to begin are speakers Benjamin Sokol, G. C. Adams, and W. A. Hermonat. The moderator, Byron Beldon, is seated at the extreme left.

A night session at the Bellevue-Stratford Hotel featured six experts. In front are: Dr. B. W. Shaffer; Richard Gross, moderator; and J. C. Hebert. In the back row are: Dr. W. E. Mahin; Prescott Smith; and Sam Tour.

Comparing notes at an early combination briefing session and breakfast are: A. D. Gunderson; M. A. Antis; and C. B. DeVlieg who were scheduled for a 9 a.m. technical conference at Convention Center.





With the cooperation of ASTE and its National Education Committee, the University of Pennsylvania staged Carbide Seminars during convention week. Participating in the first day's session, from left, were: Joseph P. Crosby, new ASTE president; Dr. Carl C. Chambers, vice president in charge of engineering affairs at the university; Dr. C. Canby Balderston, dean of the Wharton School of Business; and Roger F. Waindle, immediate past president.

Carbology Dept. Photograph



By televising machine shop operations for closed circuit viewing in classrooms, optimum visibility was assured the large group that turned out for Carbide Seminar meetings. Opening day attracted an attendance of 453 and the succeeding days averaged close to 200.

Principal participants at the Regional Educators' Conference held April 30, from left, included: A. R. Diamond, chairman of the 1953-54 ASTE Education Committee; Prof. O. W. Boston, chairman of the Department of Production Engineering at the University of Michigan; Gordon B. Carson, dean of the College of Engineering at Ohio State University; Carl C. Chambers, vice president in charge of engineering affairs at the University of Pennsylvania; Harold A. Bolz, head of the Department of General Engineering at Purdue University; and Guy Kleis, manager of the Central Technical Department at Westinghouse Electric Corp.



Variety Characterizes

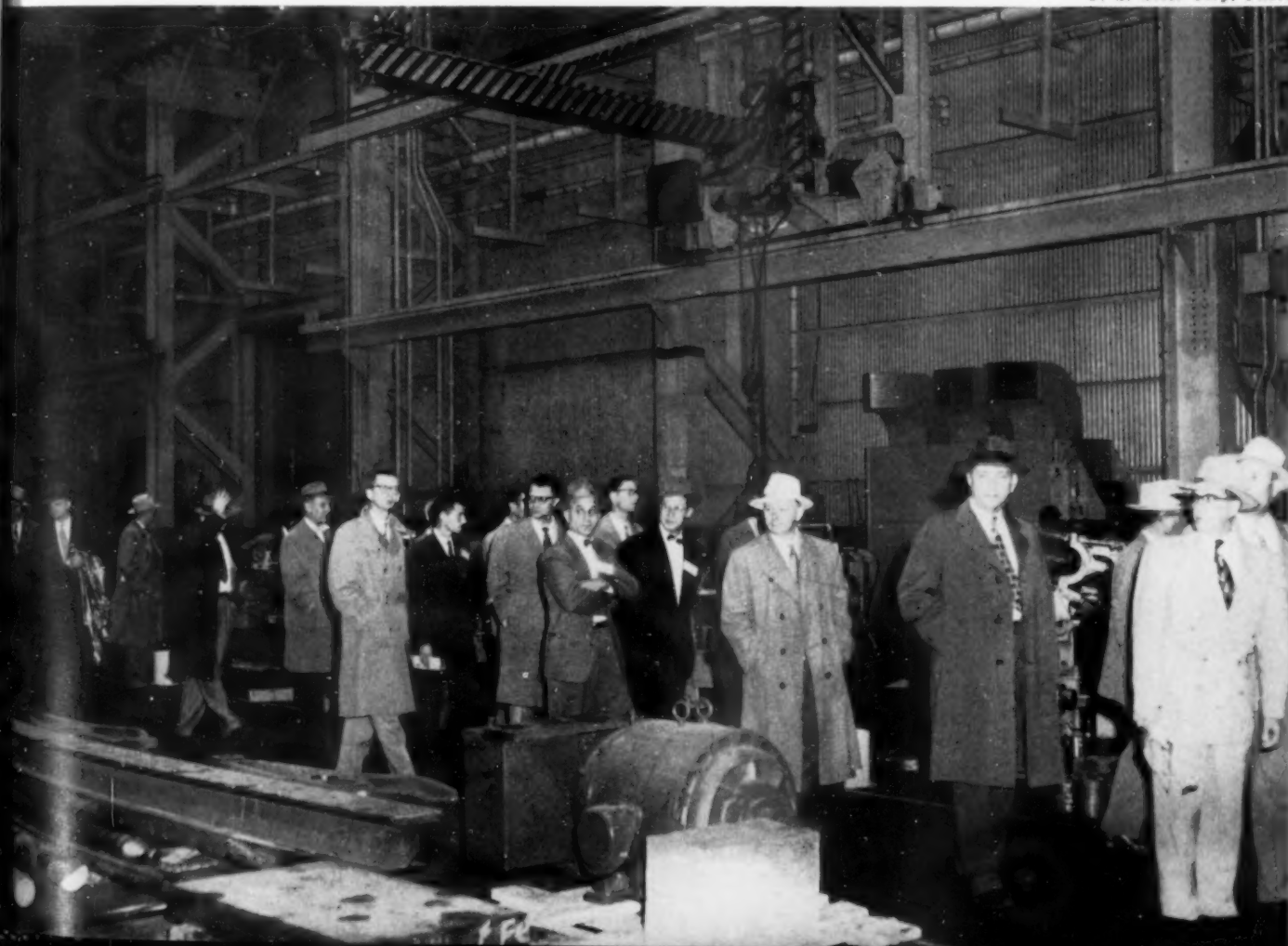
CONVENTION EVENTS

Ladies' activities included a trip to Valley Forge. Signing up for the event, from left, are: Mrs. John X. Ryneska, Mrs. Harold E. Collins and Mrs. Roger F. Waindle. Registration was handled by Mrs. Edmund Hollingsworth and Mrs. Emil Kitzman, committee chairman.



Six companies in the Philadelphia area were toured by ASTE members attending the exposition. Shown here is a group visiting a machine shop at the Fairless Works of United States Steel Corp.

U. S. Steel Corp. Photo





At the press conference held for Sir Walter Puckey, right, head of the Institution of Production Engineers, questions are put to the British guest by Ed Karpick of Denham & Co. and Roger F. Waindle, immediate past president of ASTE.



Canadian members got together for their annual breakfast which was held this year at the Ben Franklin Hotel in Philadelphia. A capacity crowd turned out for the event.



Another group of Canadian members is pictured here. Both photographs were taken by R. Eric Crawford, editor of *Canadian Machinery*, who very kindly furnished a set of prints for use by *THE TOOL ENGINEER*.

THE RESEARCH FUND COMMITTEE

By Nancy L. Morgan

News Editor

Present operations of ASTE's newest committee—the Research Fund Committee—were outlined recently by Chairman Robert B. Douglas, after a meeting held at the Waldorf-Astoria in New York City.

Working with the broad purpose of encouraging research work in the tool engineering field, the committee has postponed the undertaking of pure or basic research and has decided that projects adopted at this time should be of a more practical nature and should show promise of producing data which will have immediate usefulness.

Well over two dozen possible programs are now under active consideration by members of the Research Fund Committee. Announcement of the first ones to be adopted is expected this summer.

Some broad criteria have been established by the committee for judging the acceptability of research projects. These requirements indicate that ASTE research projects will:

- Fall within the broad field of tool engineering

- Be on a subject about which no other group should be expected to take action

- Be applied research

- Be conducted so that the maximum of student training is accomplished

- Be expected to produce results of interest to a sizeable group of tool engineers and advance the science of tool engineering

- Provide for a saving of strategic material or manpower or provide some other economy of operation

- Provide results readily available to all members of the Society

The Research Fund Committee decided it has three broad fields of usefulness. It will sponsor such projects as its own funds will allow. It will offer its services, those of its advisory

subcommittees and its research director to supervise research sponsored by others. And the committee will be available to furnish management for memorial research funds received as grants or gifts.

Much of the research effort will be done under direct contract sponsorship from the ASTE Research Fund, according to present anticipations. However, it is believed that circumstances will often arise which will make fellowships and grants-in-aid the most desirable methods of operation. The committee feels that aid in the completion of particularly interesting theses will produce useful returns.

In addition, the committee looks forward to working with the ASTE National Honor Awards Committee in setting up monetary and prestige awards for outstanding research work, with the prime objective of stimulating graduate and faculty research in the tool engineering field.

In addition to Mr. Douglas, president of Godscroft Industries and Specialoid Ltd., St. Eustache, Que., Canada, and a past president of ASTE,

others serving on the Research Fund Committee are:

Wallace E. Carroll, president of Simpson Electric Co., American Gage & Machine Co., Affiliated Screw Products Co., Sebold Manufacturing Co., and Porter Manufacturing Co., all of the Chicago area.

Roger E. Gay, president of Bristol Brass Co., Bristol, Conn.

Ralph J. Kraut, president of Giddings and Lewis Machine Tool Co., Fond du Lac, Wis., and chairman of the board of Kaukauna Machine Corp., Kaukauna, Wis.

Dr. W. E. Mahin, technical director, Research Center of Vanadium Corp. of America, and special consultant to the minerals and metals advisory board of National Research Council and the ship steels committee of the National Academy of Science.

Colonel Daniel J. Martin, vice president in charge of engineering at Hughes Tool Co., Houston, Texas.

Louis F. Polk, president of Sheffield Corp., Dayton, Ohio.

Joseph Sunnen, president of Sunnen Products Co. of St. Louis, Mo.

The Research Fund Committee was established to administer the ASTE Research Fund which was set up by the Society's Board of Directors in 1950. Members of the committee, who received permanent appointments from the Board, recently hired Colonel Leslie S. Fletcher as research director to assist in carrying out its functions of catalyzing research in the broad field of tool engineering.

Sums of money already presented to the Research Fund by the Society were increased by \$100,000 at the 1954 meeting of

Board of Directors of the Society.

In addition to direct support by ASTE, the Research Fund looks forward to receiving grants of money for use in sponsoring particular research projects, establishing memorial research funds and in setting up memorial fellowships to be awarded research workers.

Suggestions for ASTE research projects and programs are always welcome and should be directed to Col. Leslie S. Fletcher, research director, ASTE National Headquarters, 10700 Puritan Ave., Detroit 38, Michigan.



Hendrick Hudson chartering ceremonies were held in Latham, N. Y. Joseph L. Petz, chairman of the National Editorial Committee presents the charter to Macmillan McElwain, first vice chairman, in the unavoidable absence of Chairman Lisle Morse. At the head table are Richard A. Smith, a national director; Harry E. Conrad, executive secretary; and Joseph P. Crosby, then first vice president of ASTE.



Western Reserve Chairman Don Ziliox, left, is congratulated by L. B. Bellamy, past president of the Society after the chartering ceremonies in Youngstown, Ohio.

Merrimack Valley's new chairman, Ralph I. Robbins has just received the charter from Joseph P. Crosby, then first vice president of the Society. Looking on are Fred T. Goodwin, Jr., first vice chairman; and Ernest Desrochers, second vice chairman. The program took place in Lowell, Mass., at the Rex Grill.



ASTE CHARTERS

*three
new chapters*

By Edith R. Saunders

Assistant News Editor

Membership in the American Society of Tool Engineers continues to climb steadily. More than 29,000 members are now listed on the national roster with the chartering of the 113th, 114th and 115th chapters during the months of March and April. All three chapters were chartered in the span of two weeks.

The new chapters are Western Reserve in Ohio, Hendrick Hudson in New York and Merrimack Valley in the Merrimack Valley area of Massachusetts and New Hampshire.

Although actually chartered first, Western Reserve chapter is number 115. Chapter numbers are assigned in the order that the charter applications are received at national headquarters, and have nothing to do with when the chapter is chartered.

Western Reserve was chartered in ceremonies at the Tod Hotel in Youngstown, Ohio, on March 18. The new chapter has more than 125 members and serves the Youngstown-Warren area with members also coming from Girard and Niles.

The group was honored by the attendance of Mayor Frank X. Kryzan who welcomed them to the area and wished them continued success in their endeavors to serve the community and industry.

Andrew B. Clark of Cleveland, chairman of the National Membership Committee, presented the charter to Chairman Donald V. Ziliox, who was elected to lead the chapter in its first year of ac-



Mayor Frank X. Kryzan, second from left, was a special guest at the Western Reserve chartering. To the Mayor's right is Chairman Don Ziliox, and on his left are L. B. Bellamy and Andrew B. Clark, then chairman of the National Membership Committee and now a member of the Board of Directors.

tivity. Mr. Clark also reported in the growth and progress of the Society and revealed that Ohio led all other states in number of ASTE chapters, with this, the eleventh chapter.

Leslie B. Bellamy, Detroit, past president of the Society and a national director, swore in the officers. Chairman Don Ziliox, tool engineer at Brainard Steel Div. in Warren, will have on his executive committee: first vice chairman—Floyd R. Beatty, master mechanic at Metal Carbides Corp. in Youngstown; second vice chairman—Eugene D. Helfer, process engineer at Mullins Mfg. Co. in Warren; secretary—Edward J. McCabe, plant superintendent, General Extrusion, Inc. in Youngstown; and treasurer—Harry F. Hall, engineer at Youngstown Steel Car Corp. in Niles.

Mr. Bellamy addressed the assembled group on "The Impact of the Tool Engineer on Our Modern Economy," explaining the role of the tool engineer and what he means to modern society.

Frank Flannery, area lieutenant of the National Membership Committee, who was instrumental in getting the chapter organized, was on hand to give the new chapter a send-off, as was Marvin J. Bunting, representing national headquarters.

A solemn and reverent note was added to the meeting by Rev. Thomas Murphy, who offered the invocation, and Rev. R. M. Lautenschlager, who gave the benediction. (Continued on next page)



Leslie B. Bellamy, far right, swears in new officers of the Western Reserve chapter who are: from left, Harry F. Hall, treasurer; Eugene D. Helfer, second vice chairman; Edward J. McCab, secretary; Floyd R. Beatty, first vice chairman; and Don Ziliox, chairman.

The oath of office is administered by Joseph P. Crosby to new Hendrick Hudson officers. From left are: Macmillan McElwain, James Cardone, Felix R. Adams, and Fred Gras. Seated at the head table are Messrs. Smith, Petz, and Conrad who attended the chartering ceremonies.



Chairman Don Ziliox has announced the chapter committee chairmen who will help him in the first year of activity. They are: constitution and bylaws—Robert C. Wooftee; editorial—W. E. Armstrong; membership—Joseph Faulkner; standards—Eugene Boron; program—Charles Ramsey; public relations—J. R. Workman; and education—Hazen Hunter.

Hendrick Hudson Chartered

On March 31, nearly 120 members and guests were on hand at the Circle Inn in Latham, N. Y. to witness the chartering of the Hendrick Hudson chapter. This new chapter will draw its membership from the Troy-Albany area.

Many national ASTE figures attended the chartering ceremonies, including Joseph P. Crosby, 1953-54 national first vice president; Richard A. Smith, member of the National Board of Directors; Harry E. Conrad, executive secretary of the Society; Joseph L. Petz, chairman of the National Editorial Committee; and William W. Schug, area captain of the National Membership Committee. Marvin J. Bunting represented national headquarters.

Mr. Conrad, master of ceremonies, introduced Mr. Crosby, who outlined the purposes of ASTE



Hendrick Hudson's new charter is proudly displayed by First Vice Chairman McElwain. Second Vice Chairman Cardone, Secretary Adams, and Treasurer Gras.



Guest speakers at the Merrimack Valley chartering were: left, Albert M. Sargent, past president of the Society; and John X. Ryneska, chairman of the National Constitution and By-laws Committee.

and activities of the Society. He also congratulated William Schug who did such a commendable job organizing the chapter.

The oath of office was administered by Mr. Crosby to Macmillan McElwain, first vice chairman, of Consolidated Metal Products Co.; James Cardone, second vice chairman, of Watervliet Arsenal; Felix R. Adams, secretary, of Albany Designing, Inc.; and Fred Gras, treasurer, of Behr Manning Corp. Newly elected Chairman Lisle Morse of the Ford Motor Co., was unavoidably absent.

Joseph Petz then presented the charter to Mr. McElwain in the absence of Mr. Rose; National Director Smith presented the chairman's pin; and Marv Bunting presented the membership kit to Second Vice Chairman Cardone.

The new committee chairmen appointed by Chairman Morse are: constitution and by-laws—Frank A. Miller; public relations—James G. Kiernan; membership—William G. Edmiston; program—Malcolm C. MacKenzie; education—Charles Hine; and finance—David D. Bone.

Merrimack Valley Ceremonies

Merrimack Valley chapter's chartering night was attended by 250 members and friends at the Rex Grille in Lowell, Mass. The chapter encompasses the large industrial area north of Boston with membership coming chiefly from Amesbury, Andover, Haverhill, Lawrence, Lowell, Merrimac, Methuen and Newburyport in Massachusetts. In New Hampshire, Derry, Manchester, Nashua, Hudson, Salem and Windham will be represented.

The group was especially proud to have Albert M. Sargent of Detroit, as their special guest of honor. Mr. Sargent is a past president of ASTE, a

well-known industrial leader, a consulting engineer, as well as a native son of New England who started his profession in Merrimack Valley.

Harry Conrad, executive secretary, as master of ceremonies, introduced the speakers on the evening program and the officers and guests at the head table, including Joseph P. Crosby, national first vice president; Richard A. Smith, a member of the National Board of Directors; and Marvin J. Bunting of the national headquarters staff.

Mr. Crosby presented the charter to the newly elected chairman, Ralph I. Robbins, assistant to the staff engineer, Vectron, Inc., Andover, Mass.; and inducted the new officers.

Serving with Chairman Robbins will be: first vice chairman—Fred T. Goodwin, Jr., partner, Goodwin & King Engineering and Drafting Service in Hudson, Mass.; second vice chairman—Ernest Desrochers, product engineer, Towle Mfg. Co., Amesbury, Mass.; secretary—William P. Hamblet, purchasing agent, Hamblet Machine Co., Windham, N. H.; and treasurer—Harry E. Clement, tool engineer and estimator, Rollins Engineering and Machine, Inc., Nashua, N. H.

Mr. Crosby congratulated the local organization for its accomplishment and fine showing in membership. Marv Bunting spoke on the bond between national headquarters and the local chapter and presented the official membership kit to the chapter.

Chairman Robbins has already appointed his new committee chairmen. They are: constitution and by-laws—Thurston D. Monson; editorial—Ralph L. Draper; membership—Maurice Subilia; standards—John J. Haley; program—Fred Goodwin; public relations—Arthur E. Clement; education—Carol Dunn; and professional engineering—James D. Casey.

Marvin J. Bunting, left, from National Headquarters, presents the chapter membership kit to Merrimack Valley's membership chairman, Maurice Subilia.





An informal conference at the head table finds Arthur Cervenka, left, Hartley Barclay and Roger F. Waindle, covering last minute details of the banquet activities.

New York Area's Second Annual

TOOL ENGINEERS' DAY

By Jerome Barfus
Editorial Chairman
Long Island Chapter

Discussing program plans for the banquet are: Hartley W. Barclay, Sidney H. Carpenter, George Bennett, Admiral R. T. Cowdrey, George McLaughlin, and Arthur Cervenka.



"The tool engineers of America have made an outstanding contribution to the progress of American industry, in fact, of American civilization. A large measure of our famous American 'know-how' is founded upon the excellence of the tools that are used to produce the machinery which makes our nation pre-eminent. For the efficiency of those tools, we are in debt to the engineers who design and create them. Their accomplishments deserve the deepest gratitude of the American people."

With these words, Governor Thomas E. Dewey of New York saluted the tool engineering profession in his letter of greetings on the occasion of Tool Engineers' Day held April 6, 1954.

This was the second year that the ASTE chapters in the New York area have sponsored an all-day program of activities for tool engineers in the metropolitan New York City and nearby areas. Long Island acted as host chapter. Sponsoring chapters also included: Greater New York, Mid-Hudson, Northern New Jersey and Paterson.

In the course of the day, about 500 tool engineers took part in the program, which consisted of



A record crowd attended the Tool Engineers' Day banquet held in the ballroom of the Hotel Commodore.

plant tours, an afternoon panel discussion, and an evening reception followed by a banquet in the grand ballroom of the Hotel Commodore in New York City.

The head table at the banquet was occupied by many prominent representatives of industry, the military and the financial world. National officers of the American Society of Tool Engineers were represented by Roger F. Waindle, 1953-54 president; Joseph P. Crosby, 1953-54 first vice president; and Richard A. Smith, a national director.



Morehead Patterson



James D. Mooney

Also attending were: Arthur T. Roth, president of Franklin National Bank, who was master of ceremonies; Morehead Patterson, president and chairman of the board of American Machine & Foundry Co., who was a guest speaker; James D. Mooney, president of R. Hoe & Co., who was also a guest speaker; Admiral R. T. Cowdrey of New York Naval Shipyard and many others.

Mr. Roth, greeting the 500 guests, commented that our "natural resourcefulness rather than our

natural resources" was the key to America's growth and superiority. In their addresses, Mr. Patterson and Mr. Mooney also reaffirmed America's strength through ingenuity, culture, enterprise and adaptability.

The panel earlier in the afternoon was attended by about 100 persons who heard discussion on various phases of the tool engineering role in industry.

Participants included: Dr. Robert S. Aries, New York consulting chemical engineer and president of Aries Laboratories, Inc.; Fred H. Guterman, manager of sales planning for the Arma Corp.; Sidney P. Shipman, president of Varick Machine & Tool Works; Simon D. Strauss, vice president of American Smelting and Refining Co.; and T. E. Veltfort, manager of Copper and Brass Research Association.

In addition to the official letter from Governor Dewey of New York, greetings were received from Governor Robert B. Meyner of New Jersey and Mayor Robert Wagner of New York City.

The Tool Engineers' Day afforded an excellent opportunity for the tool engineers in the area to meet members from other chapters and broaden their base of tooling information by discussing mutual problems. The huge success of the event was the result of the combined efforts of many persons, who were individually recognized and thanked at the banquet by Arthur Cervenka, past chairman of Long Island chapter, who was chairman of the executive committee which planned and executed the program.

Other members of the committee were: George Bennett, George McLaughlin, Eugene Roth, John Barnes and Hartley W. Barclay.

Hartford Award Goes to Paul E. Dillberg

Hartford—The annual service award of Hartford's ASTE chapter was presented this year to Paul Erik Dillberg. Omer A. Gingras, past chairman of the chapter, made the presentation as a token of appreciation for Mr. Dillberg's services to the Society during the past year.

Newly installed as treasurer, Mr. Dillberg has been associated with the drill and lathe chuck industry for more than 18 years. —A. Douglas Proctor

Engineer Speaks on Powder Metal Processes

Los Angeles—An audience of 150 members and guests of the Los Angeles chapter heard a talk on powdered metal processes at the April meeting. Speaker at the session was Philip V. Tarr, assistant general manager and chief engineer of Kwikset Metal Products Div. of Kwikset Locks, Inc.

Mr. Tarr showed a color and sound film on methods of mixing, forming and processing powdered metal parts.

—John Boettgenbach

John Harrington Heard at Memphis Meeting

Memphis—ASTE members in Memphis met April 9 at the Claridge Hotel. The speaker for the evening was John Harrington, chief engineer of the DoAll Co. He presented a technicolor film on "Proper Selection of Surface Grinders" and discussed proper wheel dressing.

Crockett Ellis was elected to fill the vacancy of chapter secretary which occurred when Bob Galloway was transferred out of town and resigned the position.

—Frank Fly



Decatur's new officers were installed by Willis G. Ehrhardt, seated, left, a national director of ASTE. Shown with him, also seated, are: Arsene Pretot, chairman; W. J. Highley, first vice chairman; and John A. Maher, second vice chairman. Standing: Lou Slager, area membership captain; Richard S. Hauffe; C. L. Schleiser; J. W. Miller; A. R. Gatts, treasurer; and J. B. Clark, secretary. At the same meeting Gordon Turnbull of Marvel-Schebler Division of Borg-Warner Corp. showed film on industry entitled "In Our Hands."—J. B. Clark.

"Grinding Carbides" Is Topic for Lima Program

Lima—"New Developments in Grinding Carbides" was discussed at the April meeting of the Lima chapter. Frederick J. Bene, Ohio area field engineer of the Norton Co., was the principal speaker. He explained the composition and function of grinding wheels, and the types of wheels for carbide tool grinding, diamond and silicon carbide.

Mr. Bene also described the diamond mines he toured on his trip to Africa. Samples of grinding wheels and a film describing the preparation and grinding of various types of carbide-tipped tools illustrated the program.

Technical questions on the subject were answered by the speaker and D. R. Salisbury of the Norton Co.

New members of the chapter—Joel Kimmell and R. E. McGranahan—were introduced by J. B. Walsh, Jr. Cyril Sterret introduced guest Chris Jensen of Copenhagen, Denmark, who is on duty in Lima setting up a machine in

one of the local industries.

Dates for the next professional engineering examinations were announced along with information about the refresher course offered by Ohio Northern University.

Vincent Woodward, chairman of the newly organized North Central Ohio Section of the American Welding Society, was introduced. He described his group and expressed its desire to hold a joint meeting with ASTE in the near future.

—Donald Cox

Lima Member Named to Society Post

Bernard Bishop, production engineer at Baldwin-Lima-Hamilton in Lima, Ohio, has been named a director of the recently organized North Central Ohio section of the American Welding Society. He is a charter member of the Lima ASTE chapter.



Shown at the Lima meeting held in April, from left, are: Charles Long, William Lucas, Wes Lubensky, Gilbert Stenke, D. R. Salisbury and Carl Stoner. The session featured a program on "New Developments in Grinding Carbides" and a motion picture on the manufacture of aluminum. (Both photographs by Lyle Udall.)



Chairman R. E. Fromson, second from left, congratulates speaker Frederick J. Benn. Flanking them are D. R. Salisbury, also a speaker, and G. E. Siferd.

Editorial Chairman Wins Two Recognition Awards

Toronto—Two awards were presented to Toronto chapter's editorial chairman at the April 7 meeting. A. McKinney Rice received an award from the ASTE National Editorial Committee in recognition of editorial excellence in reporting chapter activities to THE TOOL ENGINEER magazine and the chapter's annual merit award for outstanding service during the past year.

More than 200 attended the meeting which featured a talk by W. P. Walker, plant manager, Oakville Assembly Plant, Ford Motor Co. of Canada. In his discussion on engineering at Ford, Mr. Walker described how his plant was planned and built, and explained the engineering achievements which have made possible the production of 1000 cars and trucks a day.

Quoting Henry Ford II, he said, "We will never make a machine that cannot be substantially improved. We will never develop a technique that cannot be made substantially better. So long as research is encouraged, we will never come to the end of the road of progress." Mr. Walker, in his conclusion, said "There is no group of men more actively engaged in this search for improvements than the ASTE."

At the chapter's annual ladies' night, held April 9 at the Royal York Hotel, a record crowd of 1,000 was present. Stanley St. John and his orchestra provided the entertainment and dance music. Bruce Fairgrieve, first vice chairman, headed the committee for the event and was assisted by Howard Lush, new chairman of the entertainment committee.

—A. McKinney Rice

Tool Engineer's Role Outlined by Speaker

Albuquerque—Albuquerque chapter's April 15 dinner meeting was held at Leonard's Restaurant. Some 30 members and guests were on hand to hear Harvey G. Mehlhouse talk on "The Tool Engineer's Role in Product Design."

Mr. Mehlhouse is superintendent of manufacturing, planning and inspection, at Sandia Corp., Albuquerque, N. M. In his talk he emphasized the need for cooperation between the product designer and the tool engineer, especially the necessity for consulting the tool engineer early in the development of a design item. Mr. Mehlhouse augmented his talk with slides of tooling operations and showed samples of finished products.

—H. E. Anderson



Alexander H. d'Arcambal

Niagara Hears Electrical Engineer

Welland, Ont.—On the first day of April, Niagara District chapter turned out 70 strong for a meeting at the Rose Villa Inn in Welland, Ont. Upton Bradeen & James of Toronto were hosts to the chapter for the evening.

Featured speaker on the evening program was E. E. Opel, electrical engineer with the National Automatic Tool Co., Inc., in Richmond, Ind.

Mr. Opel spoke on "The Electrical Control of Machine Tools," giving as an example automotive machines now producing a cylinder block for a V-8 engine. It drills, reams, bores, rotates 360 degrees to remove chips, and hole gages, and all is done by electrical relays with micro or limit switches and indicating lights to draw the operator's attention to a broken drill or an undersized hole.

—William A. Yaeger

ASTE Past President Named Company President

Alexander H. d'Arcambal, a past president of the Society, was elected president of Niles-Bement-Pond Co. recently by the company's board of directors, filling the post left vacant by the death of Frederick U. Conard.

An internationally known metallurgist, Mr. d'Arcambal has been with Niles-Bement-Pond since 1919. He has held positions of metallurgist in the Pratt & Whitney Div., sales manager of the company's Small Tool and Gage Div., and general sales manager for all divisions. He was elected a vice president in 1941 and a director in 1950.

Mr. d'Arcambal, a graduate of the University of Michigan in 1912, was associated with several automobile factories in the Detroit area for five years. From 1918 until joining Niles in 1919 he was chief metallurgist with Wright-Martin Aircraft.

Also elected and assuming new responsibilities are Charles W. Deeds and Richard W. Banfield. Mr. Deeds takes over as chairman of the board of directors; and Mr. Banfield was named to the newly created position of executive vice president.

J. P. Crosby Attends Granite State Meeting

Rochester, N. H.—Guests at Granite State's April meeting included Joseph P. Crosby, 1953-54 first vice president of ASTE, and Richard A. Smith, a national director. The technical discussion on metal spinning was presented by John W. Lengbridge, project engineer, Aluminum Goods, Ltd., Toronto.

The award of the past chairman's pin was made to Jacob J. Repetto.



National ASTE officers present at the April meeting of the Granite State chapter included Richard A. Smith, seated, left, a national director, and Joseph P. Crosby, seated, center, then first vice president of ASTE. Seated with them is John W. Lengbridge, project engineer, Aluminum Goods, Ltd. Standing, from left, are: Frederick I. Wakefield, Darrell L. Mitchell, Jakob Mutzbauer, Richard N. Wiley, chairman, Walter W. Long and Gino F. Mangani.

Richard Stefane Speaks at Grand River Valley

Galt, Ont.—Grand River Valley chapter's April 2 meeting was held at Shep's Hall with Chairman Percy Barber conducting his first ASTE session. The technical speaker was Richard Stefane, manager of the Detroit office of Minneapolis Honeywell, who spoke on the application of Microswitches in industry. Slides and a motion picture accompanied his talk.

Mr. Stefane said that complete automation is still a future goal of industry which is widening the use of automatic controls in every sphere of machine operation to increase productivity, control quality, and to reduce operator hazard and fatigue.

General uses of Microswitches in home heating controls, aircraft landing gear and alarm controls, safety applications by railroad signal and control systems, were also discussed. A question and answer period followed.

The speaker was introduced by C. Bell, sales manager of Canadian Minneapolis Honeywell, and thanked by the chapter's first vice chairman, Joe Strite.

—W. C. Little

Binghamton Chapter Hears Dr. Austin

Binghamton, N. Y.—The Vestal American Legion Hall was the scene of the Binghamton chapter's April 7 meeting. Some 70 members and guests were on hand to hear Dr. Charles R. Austin give a talk on "What is Meehanite?"

Dr. Austin is director of research at Meehanite Metal Corp., New Rochelle, N. Y. He illustrated his talk with slides and followed it up with a movie entitled "Meehanite Means Better Castings."

—Paul J. Adamek



Louisville officers installed at a recent meeting, from left, include: Robert L. Lenz, delegate; George H. Wilhelm, chairman; Jermon L. Krumpelman, first vice chairman; James R. Davis, second vice chairman; Robert W. Wohlhueter, secretary; and Boyd D. Cave, treasurer.—Sam T. Gleaves



H. D. Hiatt, historian for the Indianapolis chapter, cuts the cake honoring his 62nd birthday at the April ASTE meeting. Watching the proceedings are Arthur Love, left, and C. D. Schuman, both of Merz Engineering.

Indianapolis Members Aid in Celebration

Indianapolis—The April meeting was a festive as well as informative session for members of the Indianapolis chapter. H. D. (Pop) Hiatt, permanent historian, celebrated his 62nd birthday and the chapter set a precedent by having a birthday cake for the occasion. It was cut by the honored member and shared with the 125 members and guests.

The technical session was presented by Arthur Love of Merz Engineering, Inc. His topic was automatic and semi-automatic gaging and sorting through the use of electronic equipment. Afterward a panel session was conducted by Mr. Love with the help of C. D. Schuman, chief engineer, and Malcolm Haines, electronic development engineer at Merz Engineering.

—Murray Davidson

Mid-Hudson Chapter Holds Joint Meeting

Poughkeepsie—There was a large turnout for the joint meeting of Mid-Hudson ASTE chapter and the American Society for Quality Control. Some 225 were on hand to hear Prof. William R. Mullee of New York University speak on "Work Simplification."

The professor pointed out that people are the common denominator in achieving work simplification, listing four benefits and objectives. They are: better service, reduced costs, reduced fatigue, and improved teamwork through round-table discussions. The talk was illustrated aptly by a movie on the progress of industry in the last century.

Three students from Poughkeepsie High School attended as guests.

—Davis Gale

ASTE Award Presented to Louis Schumann

Cincinnati—At the ASTE meeting held April 13, Louis Schumann, Cincinnati editorial chairman for 1953-54, was presented a National Editorial Committee award for excellence in reporting chapter activities for THE TOOL ENGINEER magazine. The presentation was made by Richard Niebusch, national delegate.

The technical program covered the topic "Tool and Die Welding." Illustrating his talk with two films, Frank E. Kessler, engineer with the Welding Equipment & Supply Co., Detroit, discussed the salvage of damaged tools and dies.

He set forth the following general procedures: determine the type of tool steel to be welded; select the proper electrode; preheat the unit; apply the electrode; and post heat or temper the weldment or unit.

—Frank H. Houston

Industrial Health Discussed at Los Alamos

Los Alamos—ASTE members in Los Alamos heard a talk on industrial health application in unusual materials at their April session. Speaker was Edwin C. Hyatt of the industrial health group of the Los Alamos Scientific Laboratory.

His interesting and informative talk was accompanied by slides illustrating the methods used in collecting, analyzing and disposing of the dust, fumes, gases and oxides that occur in this area. Many of the strange and exotic materials used in the development of atomic weapons present new problems in health and safety precautions.

Part of Mr. Hyatt's talk explained how these dangers are detected and evaluated. The rest of the discussion listed in detail just what toxicity is created, what concentration of it is injurious to health and what corrective measures have proved successful.

This information is important to tool engineers in Los Alamos as these factors must be considered in all phases of processing and fabricating such totally new materials. As these materials acquire wider application throughout the industry, the information collected at Los Alamos will be of equal value to tool engineers everywhere.

ASTE Members Tour Minneapolis Corporation

Minneapolis—Nearly 150 Twin Cities ASTE members toured the Baker-Lull Corp. as part of the chapter's April technical program. The firm manufactures materials handling equipment for construction work and is currently making equipment for the armed forces. The visitation was preceded by dinner.

—Walter J. Comstock



Kenneth A. Meade

Plastic Tooling Topic at Baltimore Meeting

Baltimore—Some 140 dinner guests were privileged to hear George M. Rice give a talk on the qualities of epoxy resins entitled "Plastic Tooling." Mr. Rice, with 18 years' experience at Ford and Lincoln-Mercury, is now with Ren-ite, Inc., and Renaud Plastics, Inc. Lansing, Mich., in the capacity of sales manager.

He showed slides of drop hammer, deep draw and blanking dies made of the new plastic. Especially interesting were the large gages for one entire side of an automobile, dimensionally stable to .003 inch, which can be produced at one-half the cost of the conventional steel counterpart in one-fifth the time and at one-third the weight.

Mr. Rice revealed other advantages of the plastic dies, gages and fixtures. They can be modified or repaired easily and quickly, and are reinforced with fibre glass cloth which withstands most drastic changes in temperature and humidity.

—Neil Heller

ASTE Past President Installs Chapter Officers

Flint, Mich.—Saginaw Valley chapter's installation meeting was held at General Motors Institute on March 18. Some 85 members and guests witnessed the installation of new chapter officers by Frank W. Curtis, past national ASTE president, and now, well-known consulting engineer. Mr. Curtis presented a thumbnail sketch of the growth and progress of ASTE, *THE TOOL ENGINEER* and *Tool Engineers Handbook*. Another special guest of the chapter was Guy M. Cowing, president of General Motors Institute.

Elmer J. Mieskowski was presented with the award for being the outstanding member of 1953-54.

An inspiring address was delivered by Kenneth A. Meade, director of education, Public Relations Dept. of General Motors Corp. He talked on "The Engineer and His Profession," stressing the importance of engineering to the American standard of living. He listed the following qualities for outstanding success: ability to get along with others; painstaking objectivity in carrying out assignments; ability to take things in stride; and ability to see need for extra preparation.

He added that men who make little progress are pronouncedly weak in one or more of the following: teamwork, integrity, health, adaptability, or willingness to work for long-range goals.

Technically creative men have the winning combination of an original questioning mind, intelligence, temperament, personality, a passion to excel, and a strong fighting spirit in the face of obstacles, according to Mr. Meade.

—Robert J. Irvin

Dayton Speaker Covers Cold Roll Forming

Dayton—E. J. Vanderploeg, chief engineer of the Yoder Co., was the technical speaker at the April meeting of the Dayton ASTE chapter. Nearly 125 members and guests heard his discussion on cold roll forming and the part it plays in the field of automation. The dinner and program were held on April 12 at Suttmiller's Restaurant. A short business session, with Chairman R. J. Dusseau presiding, was also on the agenda.

Mr. Vanderploeg described the cold roll forming process, the scope of its uses and how cold roll forming equipment is utilized. After his detailed and thorough talk, he conducted an extended question and answer period.

—William J. Killinger



Calumet Area chapter took its first plant tour on March 25 at Inland Steel Co. The group of approximately 35 members and their guests wore goggles as a safety precaution during the visitation.—C. E. Chapman



Dr. Harry B. Osborn, Jr., extreme left, swears in officers of the Northern Massachusetts chapter. From left: J. Robert Moore, chairman; Robert Huxtable, first vice chairman; Alvin Cooke, second vice chairman; Roger H. Tolman, secretary; and Elliot D. May, treasurer. Retiring chairman Glen H. Stimson, far right, takes the oath of office as national delegate.

New Haven Chapter Tours Clock Company

Waterbury, Conn.—Approximately 75 members and guests of the New Haven chapter visited the main plant and Powdered Metal Division of the Lux Clock Mfg. Co. in Waterbury, Conn., during the month of April.

The group went through the press-room, screw machine, pinion gear and assembly departments. In the press-room they witnessed a number of various progressive and deep drawing operations. In the Powdered Metal Division, briquetting, sintering and heat treating were observed.

ASTE President Addresses Machine Tool Builders

At the invitation of Herb Tiggs, an ASTE past president, President Joseph P. Crosby extended the good wishes of the Society to the National Machine Tool Builders Association in Chicago on May 6. It was the occasion of the group's spring meeting held at the Edgewater Beach Hotel.

Mr. Crosby spoke at the annual dinner on the activities of the Society and their relation to the Machine Tool Builders.

Joins Waukesha Company

Emil Gairing, founder and former president of the Gairing Tool Co. in Detroit, has joined the Waukesha Tool Co. as a stockholder, director and executive vice president. The announcement comes from Robert Brumder, Waukesha president.

After the plant tour, a social hour was held at the Waverly Inn, followed by an informal dinner and technical session.

During a short business meeting, Chairman John Brozek awarded past chairman pins to the following past chairmen: John H. Alton, Gerard P. Schoeller, John F. Sargent, Frank S. Shute, Michael Radecki, Alton V. Pollard, David J. Mathewson, Andrew P. Schoffler, Maur J. Weldon, and Fred J. Dawless.

Fred Lux, president and general manager of the Lux Clock Mfg. Co., was the technical speaker introduced by Alexander Andrews, technical chairman of the evening. Mr. Lux talked to the group on clock manufacture and powdered metal.

—Silas W. Becroft

Applications of Files Reviewed at Erie Meeting

Erie—Members and guests of the Erie chapter met at the General Electric Community Center for their April 6 meeting. Preceding the technical session the group enjoyed a smorgasbord dinner.

Program speaker was Paul J. Roddy of the Nicholson File Co., Providence, R. I. He spoke on "Manufacture, Metallurgy and Application of Files." Supplementing his talk with slides, he discussed the history of files, the old and modern methods of manufacture, file steel and heat treatment, and the general application of files.

—Samuel A. Fiorenzo

Dr. Osborn Official at Installation Meeting

Athol, Mass.—Almost 200 members of the Northern Massachusetts chapter attended the March 16 meeting in Athol and heard Dr. Harry B. Osborn, Jr., technical director of Tocco Division of the Ohio Crankshaft Co., speak on "Tooling for Induction Heating." It was the last meeting conducted by Glen H. Stimson, outgoing chairman of the chapter.

In his capacity as 1953-54 second vice president and national director of ASTE, Dr. Osborn, prior to his talk, installed the newly elected officers of the chapter.

Past Chairman Stimson presented J. Robert Moore, incoming chairman, the gavel, chapter charter, and chairman's pin and in turn, Chairman Moore pinned the past chairman's pin on Glen Stimson's lapel.

Committee appointments are as follows: program printing—Joseph A. Krysin; public relations—John N. Engelsted; editorial—Otto S. Nau; education—George Stanley; publicity—John W. Turton; professional engineering—Leslie H. Laughton; outing—Harold I. Moss; entertainment and arrangements—Clyde Simpson; advertising—William T. McBride; constitution and by-laws—Richard B. Ellis; membership—Stuart E. Sinclair; standards—Vance I. Butterfield; and editing—Norman F. Nau.

—Otto S. Nau

George Holmes Elected Akron Chapter Chairman

Akron—George E. Holmes, section head of tool liaison in the Tool Engineering Div. of Goodyear Aircraft Corp., has been elected chairman of the Akron chapter. Assisting him in his



George Holmes, New Akron Chairman

duties will be first vice chairman—John Kurtz; second vice chairman—Louis Bokany; secretary—Jack Mitchell; and treasurer—Walter Mundy.

On March 23, Akron chapter toured the Warner-Swasey Co. in New Philadelphia, Ohio, following which installation of officers took place.

—Ted Bushnell

Committee Chairmen Announced at Worcester

Worcester—Dr. Charles R. Austin, assistant to the president and director of research of the Meehanite Metal Corp., New Rochelle, New York, was the program speaker at the April meeting of Worcester's ASTE chapter. He discussed the topic "Meehanite Castings Serve All Industry."

Committee chairmen serving the chapter during the coming year are: J. Erving England, program; Paul I. Anderson, constitution and by-laws; Franklin M. Angerine, education; Harry D. Orr, advertising; Cass Karpen, standards; Paul A. Potter, membership; John C. Lalor, editorial; George L. Gershman, entertainment; Robert S. Morrow, publicity; Charles W. Monigle, professional engineering registration; and Ralph A. Baker, E. Roland Ljungquist and John E. Rotchford, scholarship fund trustees.

—John C. Lalor

Glenn Easton Appointed

Glenn D. Easton has been appointed chief engineer for Lovejoy Tool Co., Inc., Springfield, Vt., according to an announcement by A. L. Gutterson, president of the company.

Treasurer of the Twin States chapter, Mr. Easton is a 1941 graduate of Vermont University and has been with Lovejoy's engineering department since that time.

Appointed to New Post

Harvey D. Chicoine has been appointed assistant works manager of Geometric Stamping Co., a subsidiary of Barium Steel Corp., according to a recent announcement by E. F. Carney, vice president and general manager.

Mr. Chicoine comes to Geometric from Motor Products Corp., Detroit, where he was assistant factory manager of the Mack Ave. plant.



Worcester officers were installed by Joseph P. Crosby, extreme left, now national president of the Society. From left, they are: John E. Rotchford, retiring chairman and national delegate; Leo P. Tarason, secretary; Andrew Peterson, treasurer; Bernard D. Szarek, second vice chairman; J. Erving England, first vice chairman; and Adam T. Kosciuszko, chairman.

ASTE Chairman Tells High School Students About Careers in Tool Engineering

Poughkeepsie—At the request of the guidance director of the Poughkeepsie Schools, C. Morgan Newbury, chairman of the Mid-Hudson chapter education committee, spoke to approximately 100 junior and senior high school students on "A Career for You in Tool Engineering" on March 4.

Mr. Newbury advised the students that the word "tool" refers to any instrument, material, person or thought used in performing work. The word "engineering" means science, work or profession, planning, building or managing. Therefore, he stated, tool engineering is the art and science of analyzing, planning, constructing and applying the means and the equipment for the mechanical production of industrial and consumer goods.

The tool engineering profession, according to Mr. Newbury, prior to World War II, was little recognized. However, now it is being taught in many universities and personnel of these institutions of learning are active members of ASTE.

Mr. Newbury pointed out to the students that a tool engineer is always working with people, materials and machines. New products are handed over to the tool engineer, who must plan a method or routine of manufacture, establish manufacturing times, in conjunction with setting up economical tooling to produce the product. Basically, he must be able to imagine or visualize ideas and mechanisms, analyze problems, be able to clarify them for presentation to others, be capable of planning and organizing the necessary personnel, materials and equipment, accepting responsibilities and deputizing others, with the ultimate goal of producing better quality goods or items at a lower cost.

The students were told by Mr. Newbury that to prepare for this profession, they should check their knowledge and understanding of mathematics, physics, sciences, chemistry, machine shop practice and drafting in order to convey ideas to others. He further advised the students to have their characters analyzed for initiative, patience and attitude toward others.

He stated that tool engineering is one of the most important of motivating forces and in a very large part, is responsible for the tremendous advances and progress in our present status of living. He emphasized that in the past, tool engineer ranks were filled by practical men who gained most of their engineering experience by self study and education, but that today, there are scholarships available for qualified students. He made it clear that ASTE is pledged to help educate, establish standards, cooperate with all those working in the field of tool engineering.

—Davis Gale



Heading the New Orleans chapter for the coming year, from left, are: P. A. Young, secretary; G. Gunn, treasurer; J. Cimo, chairman; S. Emrick, second vice chairman; and M. Chatry, first vice chairman. Roger F. Waindle, 1953-54 national president of the Society, was on hand to install the new officers at this March meeting held at Frank's Steak House.—P. A. Young



A group of Racine chapter members view a cutting fluid demonstration during the recent tour of S. C. Johnson & Son, Inc., held on April 5.

Racine Chapter Visits Johnson Wax Company

Racine, Wis.—Racine chapter held its monthly dinner meeting at S. C. Johnson and Son, Inc., Cafeteria on April 5 as guests of the makers of Johnson wax products.

Byron Peterson, education chairman, introduced to the group Donald Phillips who was the Racine scholarship winner for the current year. He is a student at the University of Wisconsin, Racine Extension.

George L. Boehm, chief sales engineer, Industrial Products at Johnson, talked to the group on the development and required characteristics of cutting fluids and drawing compounds. Slides illustrated chip formation and the effects of coolant on tool life.

—Alvin J. Michna

ASTE Speaker Discusses Marform Process

Long Island—Bernard Anscher of Hydropress, Inc., presented the program at Long Island chapter's April meeting. He showed a film on the Marform process of metal forming and later answered questions from the floor concerning the process. He also gave a preview of some of the large types of aluminum extrusions available with the latest giant extrusion presses which his firm is manufacturing.

—Jerome Barfus

J. Allen Carmien Becomes Corporation President

J. Allen Carmien, former executive vice president of New Plastics Corp., Los Angeles, has assumed the presidential duties of that corporation, according to a recent announcement. He is a member of the Los Angeles chapter of the Society.

A. R. Tobin Discusses Gear Manufacturing

Bridgeport, Conn.—Sixty-five members of Fairfield County ASTE chapter met April 7 at the Hitching Post Inn for their regular technical session. Program speaker was A. R. Tobin, technical engineer, Fellows Gear Shaper Co., Springfield, Vt. He showed movies to illustrate his talk on "Highlights of the Acts of Generating and Gear Manufacturing Equipment."

—Henry E. Busby

Investment Castings Topic at North Texas Meeting

The April 9 meeting of the North Texas chapter was at Amon Carter International Airport, and some 70 members and guests turned out for the event.

K. J. Yonker, plant manager at Howard Foundry Co., Milwaukee, was the guest speaker. Mr. Yonker used films and samples to augment his talk on "Precision Investment Castings."

—R. E. McMahan

Portland Chapter Holds Joint Society Meeting

The April 9 meeting of the Portland, Maine, chapter was held at the Wonder Bar Restaurant in Biddeford, Maine. Some 65 members and guests turned out for the event which was a joint meeting with Saco Lowell Shops Engineering Society.

The technical session was a film program handled by W. Wales and H. Rich of the Lynd Farquhar Co., on heretofore difficult or impossible steel turning. Much of the educational value of the film came from shots taken with a high-speed camera at 3,000 frames per second, while in constant focus on the tool point.

A correction is in order. The new treasurer of Portland chapter is Frank Thomes, not Thomas, as he was called in a previous report.

—Henry C. Hagman

Announce Committee Chairmen at San Gabriel

Azusa, Calif.—New chapter committee chairmen for the San Gabriel Valley chapter were introduced at the April 1 meeting held at the Rainbow Angling Club. Serving for this next year are: Donald Lewis, program; Richard McNeil, plant tours; Elmer Button, standards and education; Joseph S. Wajdik, public relations; Wes Patten, editorial; Dick Hursch, vocation guidance; Nevin Byrd, financial secretary.

Al Belmont of the ASTE National membership Committee spoke on the growth of the Society. Ralph Chrissie, member of the National Program Committee gave a resume of the 1954 Industrial Exposition.

—J. S. Wajdik



San Gabriel officers and guests attending the April 1 meeting included: Irving Greensides, chairman of the chapter; Ed Smith, past chairman; J. E. Riddle, chairman of the Los Angeles chapter; and Ralph Chrissie, member of the Society's National Program Committee.



ASTE officers of the Philadelphia chapter were installed by Joseph P. Crosby, now national president of the Society. From left to right are: Campbell R. Pittsinger, Walter Czarnecki, Edmund Hollingsworth, Mr. Crosby, Howard Gross and Richard Gross.

Position Wanted

Man well informed—of manufacturing, technical and personnel problems, seeks position as "functional pro-piator." Write to Box 944, Warren, Ohio.

Harry Osborn Installs Seattle ASTE Officers

Seattle—Dr. Harry B. Osborn, Jr., 1953-54 second vice president of ASTE and national director, was the installation officer for the Seattle chapter. More than 100 members and guests were present to hear Dr. Osborn give the technical talk on "Tooling for Induction Heating." He is technical director of Tocco Div. of Ohio Crankshaft Co.

Gerald Rosenfield received the membership award and William Wing was presented the merit pin for his work as program chairman this past year.

—Gerald Rosenfield

Springfield Members Hear Two Sundstrand Engineers

Springfield, Ill.—E. W. Dickett and Frank Suchanek, both engineers with the Sundstrand Machine Tool Co., Rockford, Ill., spoke at the April meeting of the Springfield chapter. Mr. Dickett, a member of the ASTE National Editorial Committee, talked on machine tools and the tool engineer. Mr. Suchanek discussed magnetic chucks and demonstrated some of their industrial applications.

Following the talks, a movie on magnetic chuck applications was shown. There was also a display of magnetic equipment and machined samples.

The meeting, held at The Mill, was attended by about 50 members and their guests.

—Charles Collier

Joseph Crosby Installs Philadelphia Officers

Philadelphia—The March 18 meeting of Philadelphia chapter was highlighted by the installation of newly elected officers, with Joseph P. Crosby, 1953-54 national first vice president, doing the honors. Mr. Crosby also presented the past chairman's pin to Retiring Chairman Campbell R. Pittsinger, and the chairman's pin to Edward Hollingsworth, new chairman.

Bill Chalfont received a pin for outstanding service to the chapter, and Jack Schroth, editorial chairman, received a plaque awarded by the National Editorial Committee, for outstanding chapter news coverage in THE TOOL ENGINEER.

The guest speaker on the evening program, A. E. Glen, was introduced by Richard Gross, new vice chairman. Mr. Glen, manager of die and wear parts sales, Carbology Div. of General Electric, spoke on "The Over-All Use of Tungsten Carbide Dies in Industry."

Mr. Glen placed special emphasis on the fact that there are many grades of carbides available, varying in hardness. He told the group that carbide is now obtainable in a single piece weighing as much as 4,000 pounds. —Jack Schroth

Discussion on Plastics Heard in Milwaukee

Milwaukee—Appy Juras, midwest manager for Rezolin Inc. of Los Angeles, Calif., spoke at a dinner meeting of the Milwaukee ASTE chapter on April 8. His discussion on the development of plastic tooling was heard by more than 180 members and guests who attended the session at the American Serb Memorial Hall.

Mr. Juras said that four kinds of plastic have been developed for die making and are being used in the actual production runs in the automotive, aircraft, stamping and appliance industries. Although plastic cannot yet compete with steel in long production runs, one of the biggest advantages for



Walter Behrend, right, received the Milwaukee award pin for outstanding service to his chapter.

the manufacturer in using plastic tooling is the lead time gained in putting the product on the market.

Before the technical program got under way, the chapter watched a sound film on the Milwaukee Braves, entitled "The Milwaukee Story."

—Steve Heinzen

Ralph Cross Named U. S. Technical Advisor

Ralph E. Cross, executive vice president of The Cross Co., Detroit, has been named technical advisor for the United States during overseas conferences on control of strategic materials.



Dr. Harry B. Osborn, Jr., extreme left, administers the oath of office at Seattle's installation meeting. From left: A. R. Jones, chairman; John Fellows, first vice chairman; Frank Stasney, second vice chairman; Robert Horn, secretary; Aubrey Dunn, treasurer; and Roy Coady, retiring chapter chairman and the 1954-55 national delegate.



The student group sponsored at Ames, Iowa by the Des Moines ASTE chapter, recently installed its new officers. Shown as they were sworn in by John M. Speck, are: Marion Hutchinson, chairman; Ross A. Stickley, first vice chairman; Richard Murphey, second vice chairman; and Roger Arends, treasurer.



Des Moines chapter officers, sworn in by Retiring Chairman Fred McMasters, include: John Hug, chairman; Frank W. LaMar, first vice chairman; Raymond Bice, Jr., secretary; and M. Paul Wahlund, treasurer. The technical program was presented by Walter R. Barrett, process engineer, Maytag Co.—Duard W. Sexton

Conference Slated for Lehigh University

Initial plans for the on-campus conference scheduled to be held at Lehigh University next fall were made April 10 at an organization meeting in Philadelphia. The first date set aside for the event, October 9, has been changed to November 13 because of a hotel conflict.

A general discussion on possible topics took place, with six general areas receiving the most consideration. These include: foundry operations, machine design, application of plastics to tooling, development of manufacturing executives, tolerances, and printed wiring.

Letters inviting suggestions for the conference program have been mailed to Long Island, Greater New York, Northern New Jersey, Paterson, Philadelphia, Keystone, Central Pennsylvania, Williamsport, Baltimore, Pottomac, and Lehigh Valley chapters of ASTE.

Principal speakers at the planning session were Arthur Diamond, 1953-54 chairman of the National Education Committee; George Kane, who was selected chairman of the committee;

Prof. Arthur Gould, Lehigh University faculty representative; and Truman Coy, chairman of the conference committee. Further news on the conference will be published in *THE TOOL ENGINEER* and also circulated by direct mail to interested chapters. —Truman Coy

Peterborough Hears Talk on Tooling

Peterborough, Ont.—The Empress Hotel was the scene of the April 1 meeting of the Peterborough chapter. Some 55 were present to hear Walter E. Rollins talk on "Screw Machine Tooling."

Mr. Rollins is assistant in charge of screw machine tooling methods at Brown & Sharpe Mfg. Co., Providence, R. I. Introduced by Charles Davidson, Mr. Rollins talked on screw machines in general and showed a film tour of the Brown & Sharpe plant in Providence. A second film on unusual applications of attachments for screw machines was also shown.

—Donald G. Moorby

coming ASTE meetings

CHAUTAUQUA-WARREN—June 19, 1:00 p.m., Spencer's Barn. Annual picnic.

DAYTON—June 17, noon, Walnut Grove Country Club. Annual golf party.

DES MOINES—June 16, 6:45 p.m., Hotel Kirkwood. "Tool Steels" by Dr. George A. Roberts, vice president, Vanadium Alloys Steel Co., Latrobe, Pa. A joint meeting of ASTE, ASME, and ASM.

ERIE—June 19, 10:00 a.m., Penelee Picnic Grounds, Annual picnic.

EVANSVILLE—June 14, 6:30 p.m., Tour of Green River Steel Corp., Owensboro, Ky.

FAIRFIELD COUNTY—June 2, Plant visitation of Sikorsky Div. of United Aircraft.

FOX RIVER VALLEY—June 11, 1:00 p.m., Columbia Tool Steel Co., Chicago Heights, Ill. Plant tour.

KANSAS CITY—June 2, 7:00 p.m., World War II Memorial Building. "Optical Tooling" by Amber Brunson, president, Brunson Instrument Co.

LEHIGH VALLEY—June 18, 6:30 p.m., Traylor Hotel, Allentown, Pa. Ladies' Night.

PITTSBURGH—June 4, 2:00 p.m., Daniels Farm. Annual picnic.

RACINE—June 4, noon, Liggett's—Brown's Lake, Wis. Annual frolic.

SANTA CLARA VALLEY—June 16, 6:30 p.m., Hotel Sainte Clair. "Heat Treating" by G. Ben Berlien, partner, Industrial Steel Co., Oakland.

SOUTH BEND—June 19, Indian Lake Country Club. Annual picnic.

SPRINGFIELD, ILL.—June 1, "Milling—New Concepts of Rigidity and Surface Foot Rates in Carbide" by Dr. Horace A. Frommelt of Detroit Milling Cutter Co., Detroit.

SPRINGFIELD, MASS.—June 14, Forum on ball bearings. Holton Fox of S.K.F. Industries will be the speaker.

TORONTO—June 18, 1:00 p.m., Uplands Golf Club. Annual field day.

TRI-CITIES—June 5, Stag outing.

Herman Gledhill Named General Manager

Herman A. Gledhill, general superintendent of Bridgeport, Conn., plant of Heppenstall Co., has been appointed general manager of the plant recently acquired by the company at Indianapolis. He is a member of the Fairfield County chapter.

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T3	Surface Finish Control with Blast Cleaning	T29	Flame Cutting with Electronic and Magnetic Tracers
T4	Ultrasonic Techniques in Industrial Cleaning	T30	Sub-Zero Chilling As An Industrial Process
T5	A Program for Developing Tool Engineers into Manufacturing Executives	T31	Ultrasonic Tools for Hard-to-Machine Materials
T6	Scanlon Employee Relations Plan at Different Production Levels	T32	Hobbing at High Speeds and Heavy Metal Removal
T7	Recent Developments in Analysis of Chip Formation	T33	Shear-Fracture Parting of Steel Billets
T9	Magnetic Holding of Ferrous and Nonferrous Materials	T34	Successful Design of Steel Parts for Cold Extrusion
T10	Jig Design for Multiple Automatic Operations	T35	An Orderly Use Classification of Cutting Fluids
T11	Process Applications for Dual-Frequency Induction Heating	T36	What's Known Today About Machining Titanium
T12	High-Production Tooling for Induction Heating	T37	Preparation and Tooling for Cold Pressure Welding
T13	How to Plan a Transfer Machine	T38	Visualizing Plant Layout in Three Dimensions
T14	Creativity in Mechanical Design	T39	The Challenge of Automation
T15	Changing Trends in Mechanical Fasteners	T40	Optical Tooling for Fixture Construction
T16	Fastening Techniques for Small Assemblies	T41	New Concepts of Gaging and Inspection
T17	The Possibilities for Castings in Airframe Design	T42	Product Design for Powdered Metal Parts
T18	Automation of Shell Molding	T43	Tooling for Powdered Metal Parts
T19	Nucleonics Invade the Tool Engineering Field	T44	Plastic Fixtures Have Wide Use
T20	Tracer-Controlled Pantographic Milling	T45	Plastic Dies Move Into Regular Production Service
T21	New Arts in Jigless Boring	T46	Plastic Auto Body Developments
T22	Chromate Conversion Coatings	T47	Welding and Brazing of High-Temperature Materials
T23	Metal Blasting and Finishing with Airless Blast Equipment	T48	Ferrous and Nonferrous Stud Welding
T24	Postforming of Thermoset Plastics	T49	Principles of Stretch Wrap Forming
T25	Improved Design and Dimensional Control for Investment Castings	T50	Planned Pre-Deforming of Shapes for Better Drawing

PANEL DISCUSSIONS

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news in

METAL WORKING

INTEGRATION OF MANUFACTURING ELEMENTS PROMOTES PLANT EFFICIENCY

Exemplifying the coordination of plant layout, parts processing, assembly operations and quality control into a unified production system toward which industry today is aiming, the new plant which Westinghouse has built for its Electric Appliance Div., merits examination.

Careful advance study created a layout keyed to the best handling of materials and parts to successive departments. Obviously such ground work facilitates assembly and is reflected in the important end results—output.

At the moment, refrigerators are coming off the assembly line at the rate of two a minute, and when production lines now planned are in operation, the figures should be considerably increased.

Beginning at the point of steel storage, where the sheet is received and inspected, it is released to the manufacturing operations where machines then take up the work. Compressor motor laminations are stamped out at the rate of 500 per minute; structural sheet is coated with a drawing compound; sheets are sheared to size, drawn, formed, trimmed and notched

Refrigerator assembly line shows cabinet shells as they are carried along on the synchronized overhead conveyors.



into small intricate parts; sides, tops and bottoms of the door frames are then joined together by welding; the refrigerator doors are formed then trimmed and pierced.

Part of the miles of conveyors serving the plant then speed subassemblies to the shell and door fabrication and metal finishing section. In another separate press and fabrication area, large presses blank and form the tops, bottoms and skirts for the inner liner or food compartment, later to be welded together in a six-wheel seam welder. Welded liners move through a metal-finishing line, are taken by overhead conveyor to the degreasing and pickling machine through cleaning and nickel coating processes, and subsequently on to the porcelain enamel department where pieces are dipped for a first coat, reinforced with a sprayed porcelain coat, dried and fired.

Food compartments are then conveyed to a subassembly area for addition of various inserts, then transferred onto the refrigerator assembly line. Here it is assembled with the outer shell.

The making of these shells is another machine function. Sheet $25\frac{1}{2}$ inches wide and ranging in length from $121\frac{3}{4}$ to $160\frac{1}{8}$ inches—long enough to reach from the refrigerator bottom on one side to the top, across the top and down the other side to the bottom—is notched and pierced. Then in quick successive operations, it is flange rolled; bent to form the sides and top like a letter U; the back sheets, back brace, and reinforcing angles are welded in a special automatic, multitip spot welder; bottom flange on the cabinet is formed in a squaring and welding jig, and the front panel, food compartment gussets and door hinge bar are welded to the cabinet; leveling screws for the cabinet and the bottom pan at the rear panel are welded; hinge mounting holes are drilled, and the piece is given a finish grinding and buffing. Now a completed cabinet

is delivered to a belt conveyor to a point where it is transferred to an overhead conveyor headed for the bonderizing oven.

Aside from the pattern of layout which facilitates efficiency, much of the automatic machine work invites attention. Typical of this planned work is the manufacture of the compressor, which, in this case, means both motor and compressor since both are hermetically sealed in the same housing. Stator and rotor laminations for the motor are automatically stamped from special electrical steel and properly annealed top efficiency. Stators pass through a pusher-type furnace to further improve the steel's electrical qualities. On the other hand, rotor punchings are annealed in separate ovens, stacked, skewed and pressed on to rotor slots in a die casting machine. The die-cast rotor is machined to dimensions and annealed to enhance the aluminum characteristics. Following this, the rotor is bored, faced and checked for tolerances.

Actual assembly begins with spraying the weld seams with a wax coating which, applied over an earlier plastic coat, doubles the assurance of an airtight cabinet. At this point glass wool insulation converges with the unit by means of an overhead conveyor that functions as a conveyor and traveling store room, bringing the glass wool from the receiving area. The refrigerating unit, again brought by conveyor is installed in place and glass wool placed in the bottom of the cabinet as a noise deadener; evaporator tube openings are sealed with mastic; the door frame trim moldings attached, and the refrigerating unit control and the food compartment light switch attached to the trim.

Representative way of the continuous quality control tests integrated into the line of work, the cabinet leak test that comes next.

As a result of the research that has gone into the packaging of refrigerators, damage in transit has been reduced to less than 1 percent on packaging and to 0.7 percent on the product.

CHANGE IN GUIDE INSERTS INCREASES ROD MILL OUTPUT

Search for more durable rod mill guides led engineers into a study of sintered titanium carbide to find a material that possessed the necessary hot-wear characteristic to make it a satisfactory replacement for various metals previously used. Now, after more than 18 months of research, carried on jointly by engineers of Kennametal, Inc. and a leading producer of rod, results indicate unexpectedly excellent performance by the sintered titanium carbide rod guide inserts.

Up to the present, a considerable cost factor has been tied in with mill down time occasioned by frequent guide changes. Now equipment may be operated as much as 200 to 310 hours between guide regrinds—this as compared to required replacement or regrinding every 3 to 10 hours maximum for conventional guide materials; in other words, an advantageous wear ratio of 45 to 1.

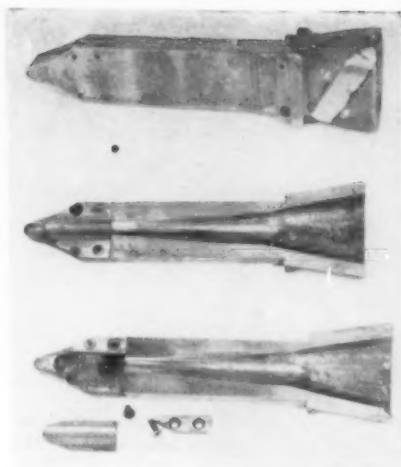
Pointing to a specific instance, a set of titanium carbide guides, which had been reground eight times, produced an average run of 200 hours per grind for 1600 hours' effective guide life. Even in excess of the long-life advantage, scrap in this case was reduced to one-fifth of its former quantity.

Sintered Carbide Adaptable for Handling Red Hot Pieces

Experiment showed that properties of Kentanium, one of the Kennametal family of sintered carbides, made it particularly adaptable for handling red-hot rod through the finishing stands of high-speed mills at 5000-5200 fpm as well as in lower-speed mills at 3200-3500 fpm. This is a particularly important point in view of the fact that prior to use of this metal no guide insert material had proved satisfactory for the purpose. Characteristics of nongalling, and of resistance to abrasion under heat and to shock, made this carbide suitable for application for hot-wear surfaces where general purpose materials often fail. At the same time, its semi-lubricating action reduces drag or pick-up, permitting mills to produce higher tonnages because of less down time.

Maintenance of Kentanium guides has been found to be fairly simple. Simplified machine shop setups serve satisfactorily to regrind the inserts in only about 10 minutes per piece.

An eight-month case history report from a plant where the new rod guides have been used, shows a considerable improvement in its mill yield, in addition to a consistent net saving in production costs of from \$2.25 to \$2.75 on



Shown at top is a typical rod mill guide while immediately below it is a guide half with a Kentanium insert in place. At the bottom is a disassembled view of the guide half, displaying the separated guide insert (left) and the steel holding plate (right).

each ton of rod produced due to increased production and reduced down time. To serve as a comparison, a second case history, involving conventional rod mill guides, indicates abrasiveness of the rod traveling from 40 to 60 miles per hour, at temperatures varying between 1600 and 1800 F. caused excessive wear in both brass and alloy guides. They tended to wear in the guiding contact faces, permitting the rod to stray within the guide, which produced a cross-sectional inaccuracy when it hit the rolls off center. As wear increased in the guides, enough movement resulted to allow the rod to veer off to one side, missing the rolls entirely and causing "cobble," a common problem under conventional work, often caused by poor guiding of the traveling red-hot rod into the rolls.

DUPLICATION FOR ROLLS BY ELECTRIC CONTROLS

Something new for the roll shop in the form of electrically controlled duplication offers an interesting study for the tool engineer.

This case concerns an automatic feature added to an hydraulic roll duplicating lathe. An electrical device, it works off the template, automatically selecting the correct operating cylinder, and making change-over from one cylinder to the other at the proper time.

Contact buttons on the template are so arranged that the contractor touches them in proper timing as it moves along. When it touches one of the buttons, the

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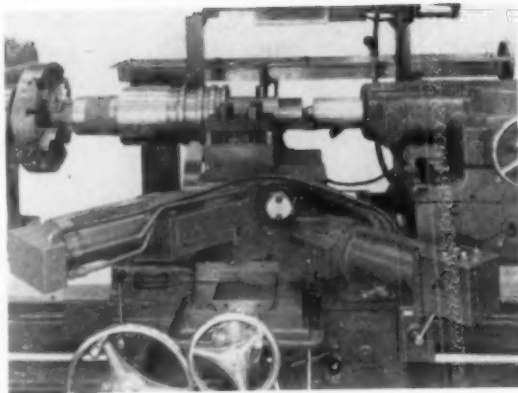
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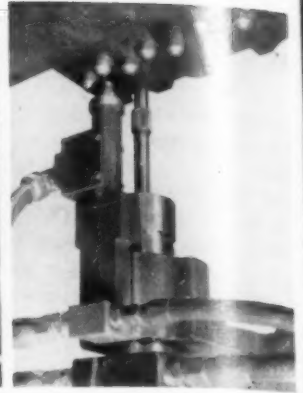
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Dept. E-6, Milwaukee 13, Wis.

INDICATE A-6-127

automatic selector mechanism, located in the control box attached to the right-hand hydraulic cylinder, is energized and the change from one cylinder to the other occurs instantly. Although this mechanism is in addition to, rather than in replacement of, manual control, the arrangement does avoid the danger of an operator failing to make the change manually from one cylinder to the other at the proper time. It should be pointed out, however, that the operator still has control of the two cylinders. The selector switch offers means of selecting either manual or automatic cylinder control at the discretion of the operator. In either case, manual or automatic, a light indicates which cylinder is in use, and this light changes automatically as the actuation is changed from one cylinder to the other, thus keeping the operator visually informed.



Above left, machine incorporating the duplicating feature is shown at work. Control box at lower right of photo shows: A, switch to select manual or automatic control; B, indicates push button that controls the cylinder selection when manual control is engaged;



C, points to lights which indicate which cylinder is in use.

Above right, contactor moves along the guiding contacting buttons, in this close up view of mechanism at center top of left hand picture.



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NEW WEAR RESISTANT CARBIDE INTRODUCED

Cutting material that suggests to users a greater resistance to wear plus a toughness that has not previously been available for machining in temperature ranges up to 1800 F is made possible with latest fabrication announced by Carboloy Dept. of General Electric. The new carbide, tabbled Grade 350, is a medium-duty, steel-cutting, cemented carbide for light roughing and general finishing, which provides up to 30 percent better performance in that machining area.

This material is the second in Carboloy's new 300 series; a heavy-duty grade 370 having been introduced some months ago.

Like the earlier developed 370 grade, the 350 is fabricated entirely under a carefully controlled manufacturing process which gives it structural rigidity, and maintain consistency of material.

Field tests being run at various plants throughout the country on difficult machining jobs indicate that unusually long production runs can be anticipated by users who are doing ordinary machining jobs where conventional cuts in reasonably uniform steel structures are involved. One of the companies testing the material is using it to machine an axle shaft—in this example, the number of units machined per grind has been jumped by more than a third.

The Tool Engineer

STUDY MANUFACTURING COST DIFFERENCES

Comparisons between the costs of manually and mechanically producing an item of electronic equipment redesigned according to the Modular Design of Electronics have been made for the National Bureau of Standards. Conclusions revealed that electronic equipment designed according to the Modular Design of Electronics can be more cheaply manufactured than conventionally designed equipment produced by existing techniques.

Modular Design of Electronics is the name now assigned to the program formerly designated "Project Tinker-toy," which project was presented in the December 1953 issue of THE TOOL ENGINEER.

Cost reductions have been found to amount to 44 percent for Mechanized Production of Electronics and 38.5 percent for MDE-hand fabrication.

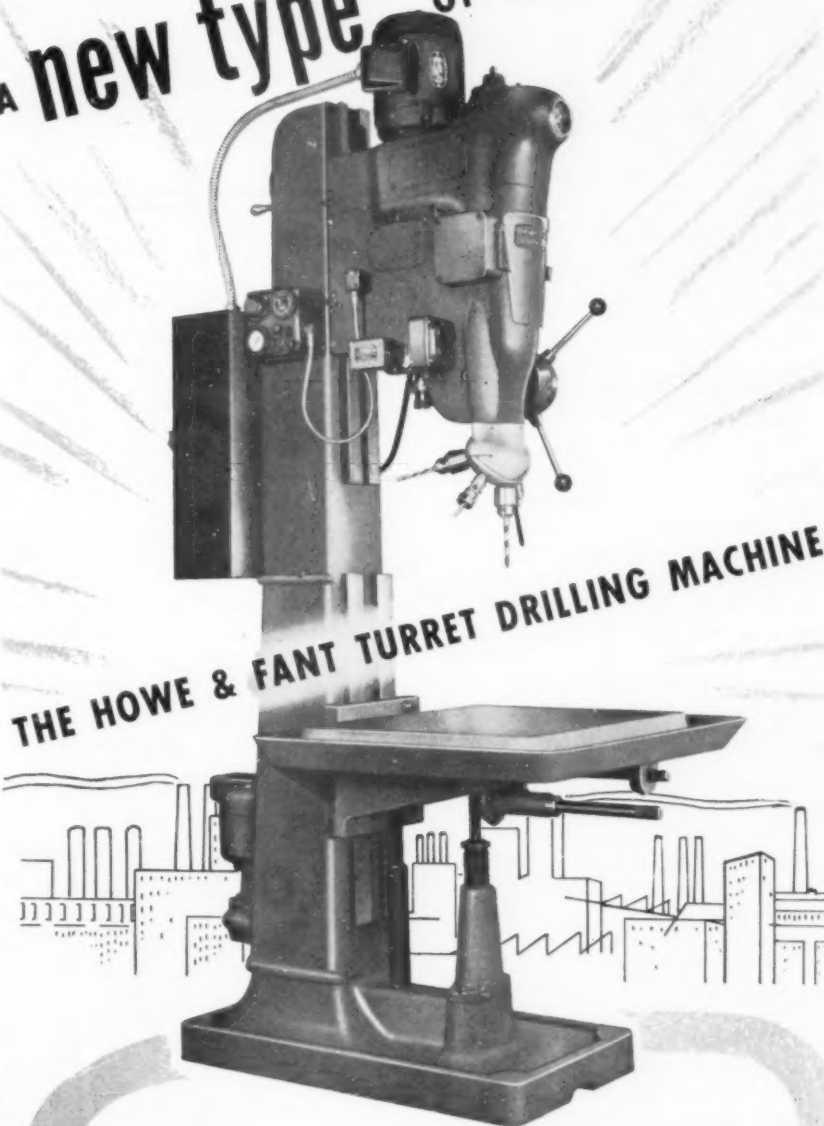
Primarily noncritical raw materials are used in the system. Many of the basic parts are produced directly in quantity from raw ingredients. These are fed into a mechanized assembly line made up of 20 machines. Here, machines provided with sets of steel stencil screens upon which the circuit configurations have been etched, print electrodes, lead connections, and other circuitry on both surfaces of the wafers and capacitors. Other machines place up to four tape resistors on a wafer automatically and assemble tube sockets. Finally a machine collects all of the component-mounted wafers and automatically assembles them into a completed module. Automatic, complete inspections are carried out on all the component parts throughout the assembly line.

Basis for the study was a search for the cost of manufacturing a specific item of electronic equipment by MDE (model shop techniques) and MPE (mechanization) as adapted and projected to conventional production practices, and then to compare these costs with the cost of manufacturing a similar item by conventional methods and practices. Manufacturing techniques observed were of a pilot plant or model shop nature.

Tabulated conclusions offer an easy and interesting comparison:

Method	Materials	Direct Labor	Manufacturing Overhead	Totals
Conventional	\$35.85	\$5.60	\$5.44	\$46.89
MDE-Hand	20.56	5.99	2.27	28.82
MPE	20.56	2.83	2.86	26.25

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TOOLS of today

Rubber-Steel Collet Chucks

An unusual tool and work holding collet chuck has been created by The Jacobs Mfg. Co., West Hartford, Conn. It is adaptable for use on grinders, milling machines, jig borers, jig grinders, lathes and various special machinery where a precise compact collet closure is required.

This collet chuck, the Model 96, has a one-piece hardened steel body, with a conical bore in the front of the body which accurately centralizes the Rubber-Flex collets. The Rubber-Flex collets consist of a permanent assembly composed of hardened steel jaws, separated and supported by a compound of Hycar, an oil resistant synthetic rubber. The synthetic rubber is molded into one continuous piece as it passes through three holes made in each jaw element. In addition to this mechanical connection between the rubber and steel jaws, there is a chemical bond between the surface of the rubber and the surface of the steel inserts.

Except in the two smallest sizes, two synthetic rubber seals protect the piece against the entrance of foreign materials, chips and coolant. One seal is on the forward end of the collet and bears

on the diameter of the work being held. The other seal operates with the conical bore of the chuck nose.

With the exception of the smallest collet whose range is 1/16 inch, all collets have a full capacity range of 1/8 inch and accuracy and gripping power are constant throughout this range.

Mounted on the body by means of a deep-groove ball bearing is a hardened steel geared sleeve having a ground threaded bore which is threadedly engaged with the collet closing nose of

the chuck. Rotation of the chuck sleeve for initial engagement of the part to be held is done by hand rotation of the sleeve.

This chuck will hold any diameter round bar between 1/16 and 1 3/8 inch by using its eleven Rubber-Flex collets, each of which has a range of 1/8 inch except the smallest (J-910) which range is 1/16 inch.

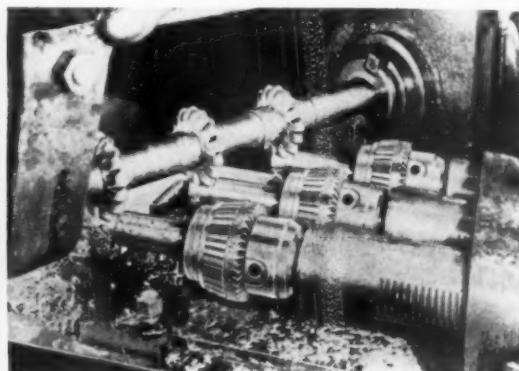
Two models are available: the 96-05 is equipped with a No. 5 Jacobs taper back mount, while the 96-F1 has a flange mount.

T-6-1301

Below left, the Model 96-F1 chuck holds work for jig grinding.



Below right, Model 96-05 chucks are utilized for production climb milling.



Chrome Plating Unit

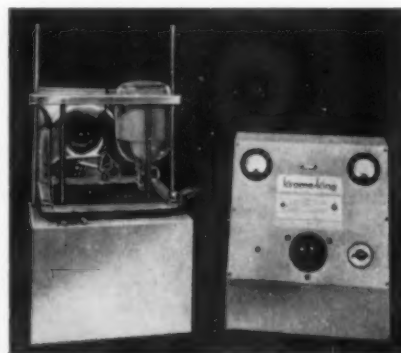
A low cost chrome electroplater and chrome solution known as Krome King units and Krome King solution has been introduced to the trade by National File Co., Lansing Mich.

The unit offers these advantages: ease of operation; accuracy in chroming to within 0.0001 of an inch; and reduction in production down time.

The simplified equipment can be operated and the solution mixed with completely accurate results by comparatively untrained personnel.

Controlled size with uniformity of deposit to within 0.0001 of an inch of

cutting tools, gages, dies, etc., is possible with the new equipment. Hardness can be controlled from a soft corrosion



resisting plate to a very hard yet ductile chrome which will absorb shock without chipping or peeling. A field tested package unit of several sizes, consists of selenium rectifier with full controls, automatic timer to control thickness of deposit, plastic tank with lead liner, thermostatically controlled heating element, plastic current deflecting table and automatic control of solution level.

T-6-1302

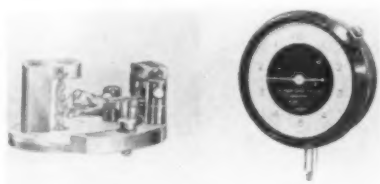
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Dial Gages

Dial Indicator mechanisms, identified as Nilcoid, that function without gear trains, eliminate 50 percent of all moving parts, gear friction, gear wear, high maintenance costs are introduced by Nilcoid Gage Co., Inc., Poughkeepsie, N. Y.

The Nilcoid movement has no teeth to wear out, consequently is not subjected to resultant excessive play.

For locations where indicators are subject to unusual shock or strain, Nilcoid dial indicators can be supplied to



embody a 0.030-inch overtravel that allows the indicator to arrive at the stop position while the mechanism continues 0.030 inch beyond. Solid nylon hand stop pins damp shock as does the newly designed shockproof spindle.

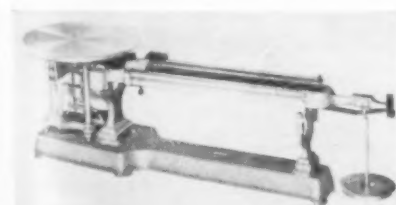
Another unusual engineering feature is the adoption of the step-down dial that brings scale and pointer to the same plane. From any angle, Nilcoid readings are uniform, legible and precise.

The gages are available in three sizes: 1 1/4, 1 11/16 and 2 1/4 inches. **T-6-1311**

Solution Balance

The Ohaus Scale Corp., 1050 Commerce Ave., Union, N. J., announces a redesigned heavy-duty solution balance rigidly constructed, and offering fine sensitivity.

Prime feature is the addition of a graduated end reading dial, which enables the user to obtain a balance position in a matter of seconds, and avoids the danger of any parallax errors. A newly developed high strength, light weight aluminum alloy beam reduces the inherent beam load, thereby increasing the sensitivity and life of the balance. The weighing platform is 11



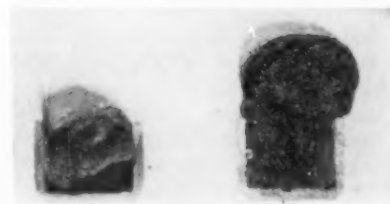
inches in diameter and is of stainless steel. Relief etched beams are also of stainless steel, thus making them ideal for use in laboratories where corrosion is a factor.

Self-aligning bearings throughout distribute the load evenly over the full length of the knife edge. **T-6-1311**

Expanding Sealer

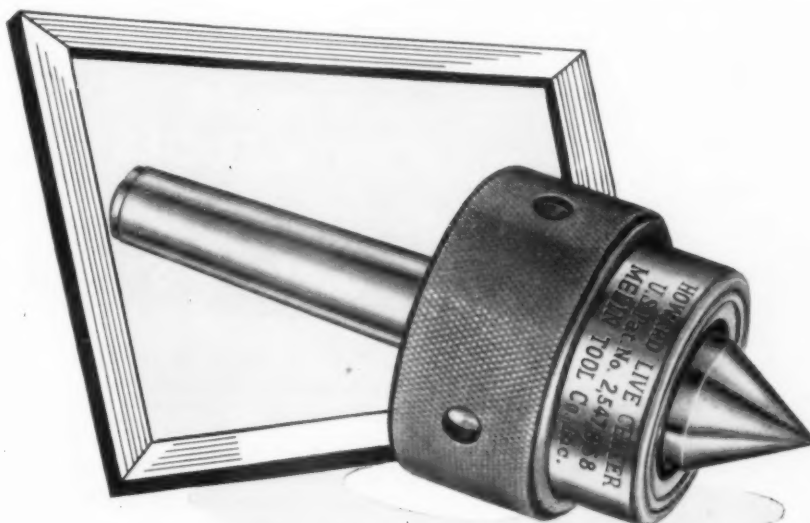
Industry is now offered an extruded rubber based sealer, applied as a flexible strip that expands uniformly when heat cured to form a positive, uniform, gasket-like material between metal surfaces over the entire length of the sealer bead, filling all gaps and openings.

This EC-1209 sealer, which has a



At left sealer has just been applied; at right it has expanded to fill area.

100-percent solids content, possesses several advantages: it can be used to seal seams which are not uniform in width. When expanded, the sealer fills the entire seam. Special flow or pressure application equipment is unnecessary. When uniform beads of sealer are applied, parts are processed immediately since no time is required for



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★ A distinctive oil seal in front of bearings protects them from all foreign matter. Chips, dirt and cutting oil cannot reach the bearings.

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**MELIN TOOL
COMPANY, INC.**
3372 West 140th St.
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solvent evaporation. There is no waste of material or clean-up problem, and excess sealant does not flow out when parts are drawn up tight.

Amount of volume increase depends on the time and temperature used in the curing process: 40 minutes at 250 F produces a swell of 70 to 80 percent, while a 15-minute cure at 350 F causes it to swell nearly 125 percent. Once cured, the sealer remains flexible to about -20 F, provides long-term service at temperatures up to 150 F, and yet withstands temperatures up to 300 F

for short periods of time without deteriorating and flowing.

Even if heat is not used, EC-1209 provides a good seal between mechanically held surfaces. More information is available from the developers, The Adhesives and Coatings Div., Minnesota Mining and Mfg. Co., 423 Piquette Ave., Detroit 2, Mich. **T-6-1321**

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"Switching to NILSON 4 SLIDES Saved us \$17,656 on metal alone"

Yes, simply by changing stamping methods, this NILSON Customer profited 4 ways:

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You, too, can enjoy these advantages in producing your own wire forms and small metal stampings. Parts such as illustrated in the margin were straightened, fed, pierced, blanked, swaged, stamped or coined, cut-off and formed **AUTOMATICALLY** in NILSON 4 SLIDES in one quick precise operation. **ONE Machine. ONE Operator.**

NILSON 4 SLIDES available in wide range of sizes: forming Wire up to 1/2" diam. in feeds to 32" max. and Metal Ribbon stock up to 3 1/2" wide. Press sections 5 to 30 ton capacity. Heavy Duty Types in 50 and 75 ton models.



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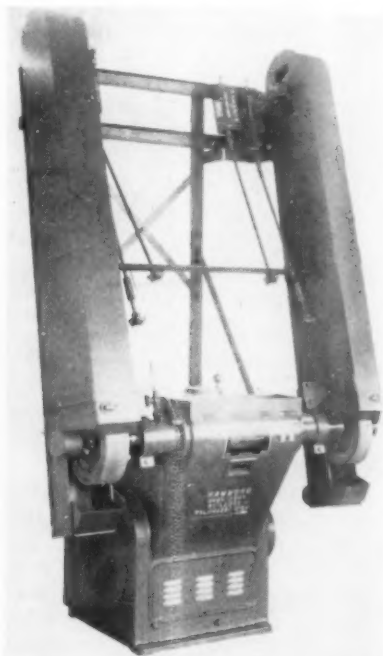


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Polishing Lathe

A compact and space-saving grinder-polisher using abrasive belts, has been introduced by Hammond Machinery Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich.

The mounting structure is attached to the base of the polishing lathe to which the backstands are mounted, instead of the more conventional method of mounting the backstands in back of the lathe.



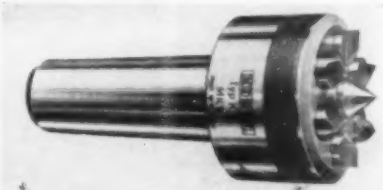
Abrasive belts up to 14 feet long can be used.

The polishing lathe is the Model VRO variable speed—from 1500 to 3000 rpm—and the backstands can be either spring or air-tensioned models.

The units are particularly adaptable in installations where abrasive belts can be used to advantage, but limited space makes it impractical to install models which mount the backstands in back of the polishing lathe. **T-6-1322**

Automatic Driving Center

Increased production, safety against accidents and accuracy in turning, milling and grinding, are the features stressed in the automatic driving center offered by Mera Machine & Mfg. Co., Dept. 51, 221 Spring St., Elizabeth, N.



The Tool Engineer

J. The workpiece can be removed and re-chucked while the machine is running. When the workpiece has been gripped, the center is automatically locked—a feature which insures both precision and safety.

For turning, grinding, etc., the customary use of dog and face plate is avoided with the automatic center.

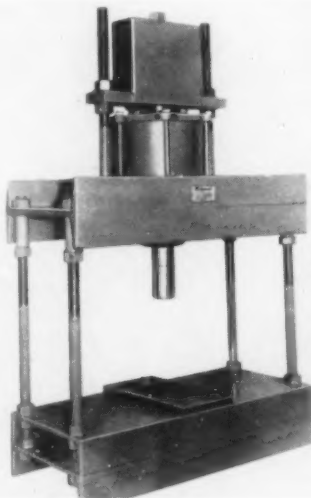
With no need for changing driving dogs to the other side, jobs can be completed in one setup. Longitudinally movable driving pins grip the workpiece regardless of the irregularities of its end face.

T-6-1331

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Bench Type Air Press

Continuous heavy use in production, assembly and maintenance is possible with the Vi-Speed Power House bench type air press, which assembles, bends, straightens, punches, stamps, trims, rivets, broaches, crimps, and swages.



The unit is made by Van Products Co., 3736 W. 12th St., Erie, Pa.

This air press utilizes Vi-Speed air cylinder power units of 50:1 ratio, 1½ and 6-inch stroke. An exclusive feature of the press is an adjustable air stroke limit control. Hand or foot controlled, it also offers unlimited pressure adjustment from feather-touch to 2½ tons.

The rigidly guided 2-inch ram is nonrotating with ram extensions supplied for quick, easy adjustment to work requirements, and will handle off-center work. Work can be entered from all four directions. The work surface frame contains an adequate size hole for shaft extensions. This is covered with a removable heavy work surface plate for fixture, tool, and die mounting.

T-6-1332

It Pays to Know Your KENDEX* Tooling

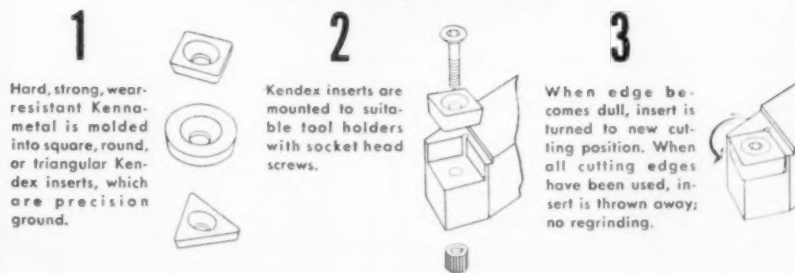


There are no substitutes for Kindex inserts. Only Kennametal Inc. makes them—and they're made only of Kennametal.

Kindex inserts are round, square, or triangular tool blanks having multiple, precision-ground cutting edges; designed for screw-mounting to enable fast, accurate indexing without resetting the tool. When all cutting edges of a Kindex insert have been used, the insert is thrown away—no resharpening.

You can obtain these advantages with Kindex tooling: (1) Minimize downtime for tool changing; (2) Eliminate tool grinding expense; (3) Prevent temptation to "save" money by reconditioning tools that have outlived their usefulness. Ask your nearest Kennametal representative for details. Kennametal Inc., Latrobe, Pa.

HOW KENDEX* WORKS



*Registered Trade-Marks

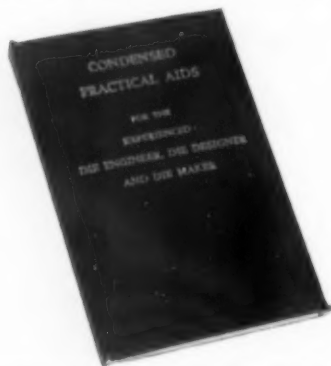
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INDICATE A-6-134

Expansion Reamer

A micrometer adjustment expansion type stub reamer has been placed on the market by EX-R Reamer & Tool Corp., P.O. Box 403, Rochester 2, N. Y.

Design of the reamer permits the use of interchangeable reamers in self-aligning holders. Precise adjustment of the cutting size of the reamer is possible since the holder works on a micrometer principle. Any dimension, within the range of the given reamer, can be produced and maintained as simply as



if setting a micrometer reading.

The simplified sizing of reamers saves considerable time, yet produces very accurately dimensioned holes.

Three sizes are offered covering a range from $\frac{1}{8}$ to $\frac{7}{8}$ inch.

Several features are of particular interest: diameter of the cutting edges may be altered by turning the graduated sleeve in the plus direction to increase it or in the minus direction to decrease it; reamer sizes change about 0.0005 between graduations on all holders; floating shank bushings, on all reamers, insure the alignment with work.

T-6-1341

Lift Magnet

A lift magnet that can lift 2000 lb of finished mild steel when powered by a common 6-volt automobile battery is being manufactured by the Sundstrand Magnetic Products Co., Div. of Sundstrand Machine Tool Co., 1020 9th St., Rockford, Ill. It is fast and easy to operate by turning the switch, rather



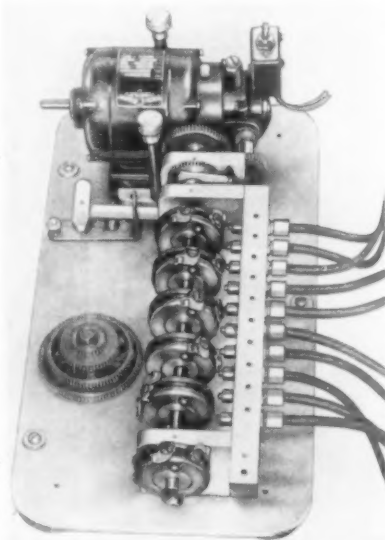
than by chain or rope hitches and eye bolts. No attached cords or cables restrict length of haul. A recessed control panel contains an operating switch, a dial to indicate the need of recharging and a receptacle for a trickle charger plug.

A 4-ampere battery charger that can be plugged into any 110-volt electrical outlet may be used for recharging a run-down battery.

The magnetizing surface is $7 \times 12\frac{1}{2}$ inches and height of the entire unit is $12\frac{1}{2}$ inches. Weight is 120 lb. T-6-1342

Electropneumatic Timer

Control of the action of air cylinders in an almost infinite variety of sequences is possible with the timer introduced by Mead Specialties Co., Dept. S-74, 4114 N. Knox Ave., Chicago 41, Ill. The normal unit, as illustrated, operates 12 single-acting or 6 double-acting cylinders, but by increasing the number of rotors and cams a larger number of cylinders could be handled.



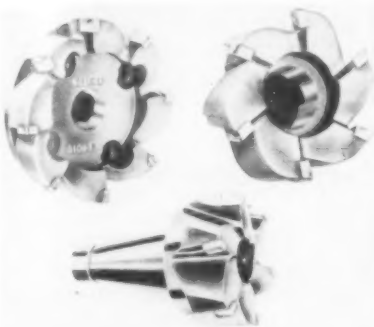
The machine consists merely of a small special electric motor which is geared to a revolving shaft. Mounted on the shaft are a series of rotors, each provided with four adjustable cams. As the cams revolve with the shaft, they trip miniature poppet valves, which convey a compressed air impulse to the operating valves. In addition to the variations in the cycle obtained by moving the cams, the duration of the cycle can be regulated by changing the motor gears. A set of 10 quick-change gears permit cycle variations from 3 seconds to 33 seconds. A lock-out lever permits instant change from continuous operation to a "one shot" push button type of cycle.

T-6-1343

Carbide Tools

New carbide tools with new, longer life bodies have been created by The Geo Tool Co., Manchester, Conn. All No. 50 shell mills, 6 and 8-inch face mills and No. 50 NMTB taper shank end mills will incorporate this production increasing structural improvement.

Even under unusually hard use, these alloy bodies appear to offer more dura-



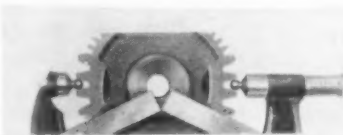
bility than conventional steel bodies and indicate a materially prolonged cutter life.

For quick, positive identification and certain rust prevention, these advanced alloy bodies will be copper or cadmium plated. **T-6-1351**

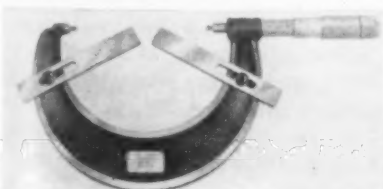
Ball Micrometer

AA Gage Co., 356 Fair St., Detroit 20, Mich., announces a ball micrometer with opposing balls, accurate to 0.0001 in. — an integral part of the micrometer. This ball micrometer is used in place of separate rolls in checking nonparallel parts. It is particularly applicable in checking of tooth thickness and pitch diameter on gears.

Parallel guides assure gear leveling and positive readings. Standard ball sizes are 1/8 to 1/4 inch in 1/64 inch increments, but other sizes are also available as specials. **T-6-1352**

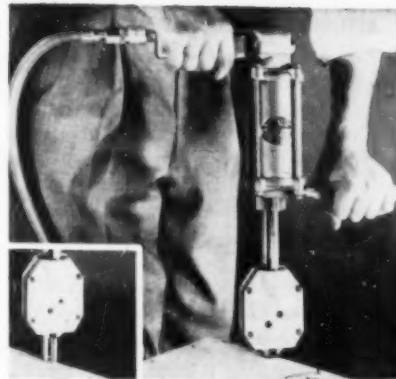


Micrometer shown below is demonstrated in photo above.



Automatic Nail Puller

Time and cost economies are the advantages offered by the automatic nail puller introduced by Oton Mfg. Co., Inc., 7310 Milwaukee Ave., Chicago 31 (Niles), Ill. It permits one man to do work of four over old hand methods. Accuracy and firm grip and pull saves the nails, does not splinter or scar wood, and saves merchandise from damage. Its operation is so effective as to make it useful in both routine and inspection-repack procedures. Operated from regular plant air line, 75 to 100 psi, the precision gripper prongs squeeze past head of nail and grip shank of nail; the powerful vice-like hold-and-pull of air unit draws nail quickly, and does not tear off heads. It is also practical for getting bent, rusted, treated or buried heads. Its quiet operation permits work-



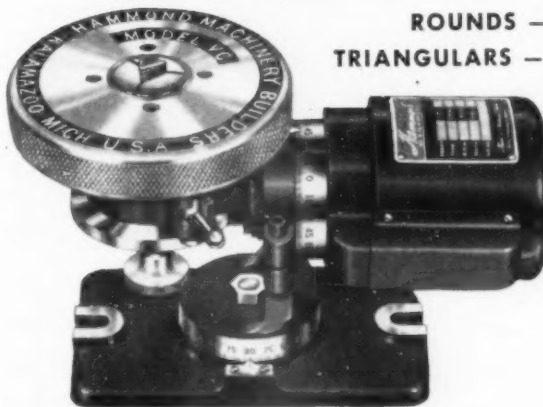
ing alongside other operations without confusion.

Three models are available: Model 14 for nail sizes 6 to 14 penny, Model 20 for sizes 10 to 20 penny, Model 20HD for 10-30 penny. **T-6-1353**

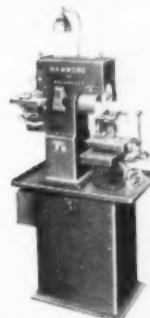
Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

INSERT GRINDING FIXTURE For Solid Carbide Tools

ROUNDS — SQUARES
TRIANGULARS — RECTANGULARS



MODEL VC, Style M Motorized Solid Carbide Insert Grinding Fixture. Style H, without motor also available. Write for Bulletin No. 235.



HAMMOND MODEL CB-77 CHIP BREAKER AND DIAMOND FINISHING GRINDER can be supplied with both the standard Any Angle Vise and the Model VC Solid Carbide Insert Grinding Fixture.

THE Hammond Solid Carbide Insert Grinding Fixture pays for itself in a few weeks. Offers a fast, economical and accurate means of grinding chip breaker grooves in round, square, triangular and rectangular shapes and for rough and finish grinding of dull and damaged carbide inserts. Motorized Style M with lug base can be mounted on most tool and surface grinders and Hammond CB-76, CB-77 and CB-77W Chip Breaker Grinders.

BUILDERS OF AMERICA'S MOST COMPLETE LINE OF CARBIDE TOOL GRINDERS

Hammond Machinery Builders INC.

1661 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

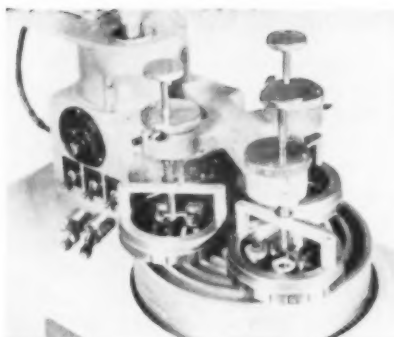
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-135

Lapping Machine

Crane Packing Co. has recently developed a method for lapping shoulder faces of shafts.

Their method consists of providing the lap plate with a series of annular grooves to accommodate the stem of the workpiece and allowing the shoulders to ride the top of the lap plate during the cycle. Fuel pump parts are pre-loaded into a special brass cylindrical work holder which has been bored out slightly oversize to the diameter of the workpiece. These special work holders provide the necessary weight and needed balancing properties.

Adjustable roller guides at the base of the conditioning ring guide stems are so located to the perimeter of the work holder that the parts being lapped



will be held in proper position. Ball bearing races in the guides reduce friction to a minimum and the work is free to rotate in its own orbit on the lap plate.

Spring loading of the conditioning rings overcomes the amount of wear

caused by the work on the lap plate. Amount of spring tension is controlled by the setscrew as shown in the foreground of the conditioning ring assembly at the left in the illustration. An indexing measure is provided on the spider bar arm cap.

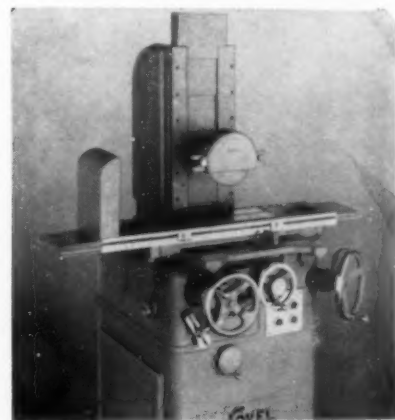
For further information contact Crane Packing Co., Dept. TE-1, 1800 Cuyler Ave., Chicago 13, Ill. T-6-1361

USE READER SERVICE CARD ON PAGE 141 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Surface Grinder

Designed particularly for gage and form tool work, as well as surface grinding, a low cost, precision surface grinder is being introduced by Covell Mfg. Co., Benton Harbor, Mich., as part of its 80th anniversary celebration.

This reciprocating table surface grinder is available with hand or mechanical feed. Longitudinal table travel is 20 inches, while the transverse table travel is 7 inches and the vertical travel of grinding wheel, 15 inches. It will

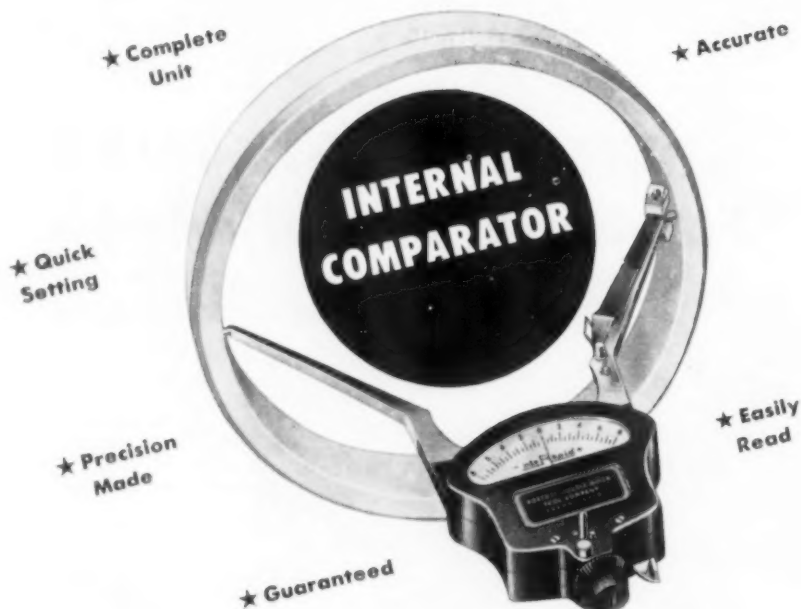


grind work 6 x 18 x 15 inches high under a 7-inch grinding wheel. Drive is by means of any 1 hp motor-driven spindle. Table speed is 15 to 50 fpm. A special 1/8 hp 1200 rpm reversing motor drives the table through variable speed pulleys.

For such work as gage grinding the elevating and transverse movements, the unit can be equipped with indicator gages for use with gage blocks or measuring rods. Other available attachments include hard chrome table ways, wet attachment, magnetic chuck, dust collector and Bijur lubricating system.

More details about the economical Covell No. 10 surface grinder are available in bulletin No. 10-54 from the company. T-6-1362

NEW "Inte Rapid"



New Internal Comparator Gage has gaging capacity from 3/8" diameter to 6" diameter. Meter-type scale, graduated in .0005", shows at a glance whether holes are oversize or undersize and by exactly how much.

Gage is designed for use on Jig Bores, Boring Machines, Internal Grinders, Lathes and for all Inspection Personnel.

For complete details . . . write for Comparator Specification sheet.



PORTAGE Double-Quick TOOL CO.

1054 Sweitzer Avenue • Akron 11, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-136

Cutting Tool

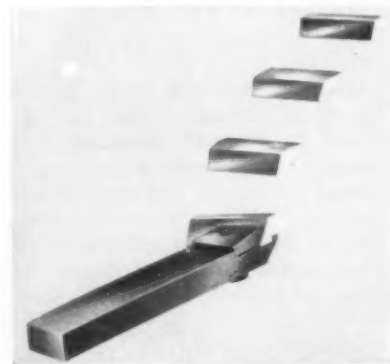
Bloom Tool Co., Detroit 38, Mich., has produced its Rapidor tools, which it has been testing in the field for some time.

Rapidor consists of two major parts—a cutter (replaceable when worn) and a holder made of heat-treated alloy steel (the latter representing an investment only in the initial purchase).

The cutting head, in choice of super high-speed steel or carbide-tipped, is made in four types—(1) for roughing, (2) for semifinishing, (3) for finishing, and (4) for forming. All are interchangeable.

In use, the desired cutting head with serrated edge is gripped in a clamp at the end of the toolholder (having a rectangular shank) and is securely locked. The same shank is used repeatedly with the various cutters as needed.

T-6-1371



Safety Coating for Shop Floors

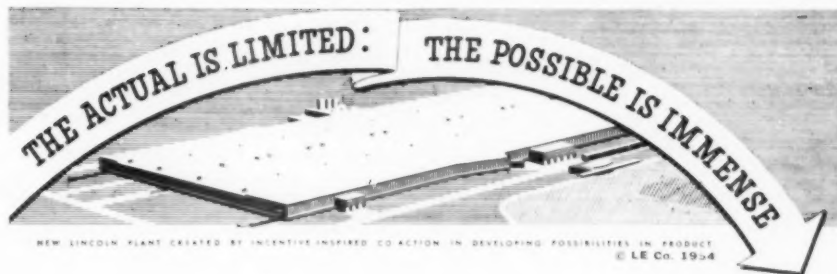
Plants and shops where oils, greases and chemicals create safety hazards and maintenance problems, may make use of NeoFloor, an economical and easily applied skid-proof surface coating for concrete, wood and metal floors, developed by the Pennsylvania Salt Mfg. Co.

The substance is a grit-like material anchored in a matrix of resilient neoprene and bonded firmly to the floor with an adhesive primer. Both primer and coating are supplied in liquid form for easy, quick-drying application with brush or roller.

As a surface coating, it is a tough, tightly bonded material, highly resistant to fumes, spillage from acids, alkalis, salt solutions and solvents at temperatures up to 220 F. Waterproof. NeoFloor is impervious to oils and greases and is easily cleaned with commercial detergents and cleaners.

Additional information may be obtained by writing the Corrosion Engineering Products Dept. of the company, Philadelphia 7, Pa.

T-6-1372



Simplifies production of drive shafts ... saves manpower with Automatic Lincolnweld

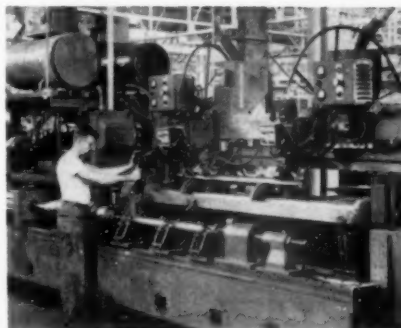


Fig. 1. Easy Operation. Fittings are simply pressed over tubular shaft with hydraulic cylinder. Assembly is then transferred to welding station for "hidden-arc" welding in granular flux with "Automatic Lincolnweld" at speeds averaging 1-3/4" in 10 seconds.

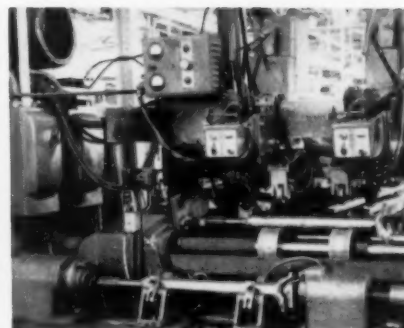


Fig. 2. Close-Up shows "Automatic Lincolnweld" heads and controls. Work varies from 1-3/4" to 4-1/2" diameter. Welding in granular flux eliminates arc rays. Each "Lincolnweld" unit is powered by 600 amp Lincoln "Shield-Arc" motor driven welding generator.

HIGH welding speeds, smooth, dense and ductile welds prompt the broad use of automatic welding in granular flux. Substantial savings in time and costs make this automatic setup practical for many short run operations as well as high production runs since high welding speeds more than compensate for set up time and fixture expense.

In the production of drive shafts shown, both ends of the shaft are welded at one time. Shafts vary from 1-3/4" to 4-1/2" diameter depending on customer requirements. Output is 50 to 90 driveshafts an hour.

CHECK THE POSSIBILITIES TODAY! Learn what new developments in faster, lower cost automatic welding are being developed at Lincoln to simplify, speed and cut the cost of your production. Write Dept. 5003. Complete information in bulletin 439.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

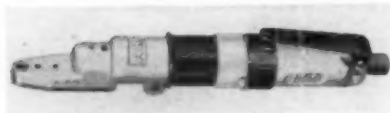
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-137

Flat Angle Drill

Special features of design which improve space-saving and ruggedness are incorporated in the flat angle drill announced by The Aro Equipment Co., Bryan, Ohio.

Head height of this air-powered drill is only $\frac{3}{16}$ inch. Spindle off-set is $\frac{1}{16}$ inch, while over-all length reaches 10 $\frac{5}{16}$ inches for model 7438.

Improved facility for drilling in close quarters or on hard-to-reach work results from this development of a different design of gears and housing. By



re-locating the bevel gears to the rear end of the housing, it was possible to decrease size where needed at the drilling end, and permitted use of heavier duty bevel gears instead of the small, delicate ones required by former designs of small right angle drills. Precision gears in the angle-head are

mounted on needle bearings for correct drilling speed and longer tool life.

Ductile cast iron, used in the right angle assembly, gives added advantage of bending characteristics. The cover plate on the ductile iron casting, also of a heat-treated alloy steel with graphite type features, adds to the strength and sturdiness of the assembly, increasing tool life as well as contributing characteristics of lubricating properties combined in the material.

Tool components are interchangeable for speed conversion. Models available with speeds of 1450, 2100, 2500 and 4000 rpm. Threaded spindle accommodates threaded drill bits and broken drill type adapters can be supplied to permit use of broken drill bits. Small external collets are available for numbered drill sizes up to and including full $\frac{1}{4}$ -inch drill. T-6-1381

A Jig Borer And Miller For Jobs Up To 30" x 48"!



- Fulfills every requirement for accurate boring, drilling and vertical milling of large workpieces up to 5000 Lbs.
- Simplified setup, operation and inspection are possible because many parts are easier clamped on a table than mounted on a horizontal machine.
- All controls are in a single movable panel. Operator can control table and spindle from most convenient location without ever changing his position.
- Infinitely variable spindle speeds and feeds. Non-gear, easily maintained direct drives provide unusual smoothness of operation.
- 35" throat capacity—safety controls for machine, job and operator—unusually heavy construction—and a dozen other exclusive features.

Ask For Brochure



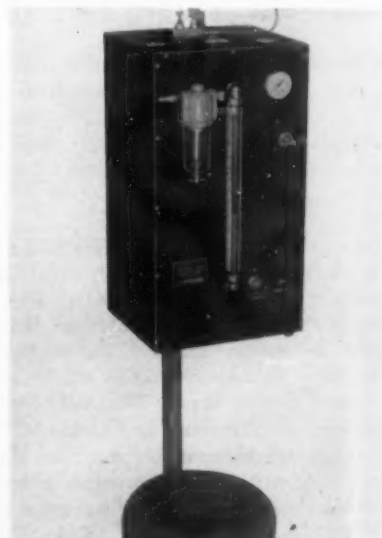
W. B. KNIGHT MACHINERY CO. • 3918 WEST PINE BLVD. • ST. LOUIS 8, MO.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-138

Cooling Unit

An improved, completely redesigned Lo-Jet Acro mist coolant system was introduced at the ASTE show by Air Conversion Research Corp., 4107 N. Damen St., Chicago 18, Ill. The newer model is not only physically more compact, but presents a master panel control for precise and constant spray regulation. It comes complete with a pedestal for mobility and brackets for permanent location installation. The spray mix control is mounted on the top of the unit, and is connected with flexible tubes of any specified length so that the control can be moved and installed at the desired location close to the cutting operation.

Tests indicate that with the newer model Lo-Jet Acro you can achieve the finest fog or an actual stream of coolant simultaneously to meet the needs of different operations serviced by the same unit. T-6-1382



Barrel Finishing Chip

The Chicago Wheel & Mfg. Co. is marketing a precision barrel finishing chip, called Novaculite. Chips of this material are said to have unusually long life, will reach hard-to-get-at indentations without wedging or clogging holes, and will not change the work while producing a fine finish to close tolerances, with uniform radii on all edges of the work.

The Novaculite chips have a unique conchoidal shape, irregularly formed with sharp edges and elongated points.

In precision barrel finishing Novaculite chips produce a mild honing abrasive action for a smooth even finish without dents, burrs or damage to stamped or cast parts. Because Novaculite chips do not charge the work with abrasives or extraneous materials, such as iron oxides, the manufacturer states they may be used for finishing parts to be used in electronic assemblies or parts that will subsequently be used for plating.

Complete information and samples of Novaculite chips may be used from the company, 1101 W. Monroe St., Chicago 7, Ill. T-6-1391

Foot-Controlled Mill Vise

Studebaker Machine Co., 1221 S. 9th Ave., Maywood, Ill., has made available a Milvise that can be mounted on machine or bench, and holds work with hydraulic pressure from a few pounds to 5 tons.

Hydraulic pressure is obtained by a foot-operator equipped with an applicator pedal that moves rear jaw of the vise forward to grip the work; another pedal applies pressure to maximum, and the third breaks the pressure, and the jaw automatically moves back for release of work.



Thus, the operator's hands are free to guide work, and safety is obtained through the fully foot-controlled hydraulic system.

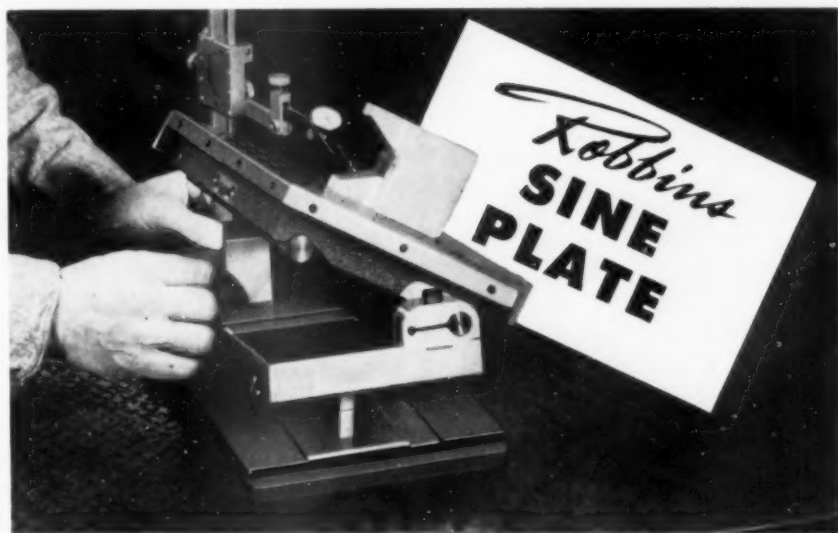
Construction of Milvise is steel. Jaw plates are hardened and ground steel and jaw faces are aligned parallel to 0.001-inch accuracy. Cross slots and side cars are provided so Milvise can be bolted either lengthwise or across worktable. V-ways and gibs assure straight line movement and square gripping between jaws. Hydraulic system parts are steel. T-6-1392

Drill Unit

Haase Engineering, Montpelier, Ohio, has introduced into its line the Model 04 air-hydraulic drill unit—a pulley drive spindle model that can be mounted at any angle. Weighing only 44 pounds, the unit is capable of production drilling operations up to $\frac{3}{4}$ inch in mild steel.

Stroke, which is adjustable to a full 4 inches, can be set up for either automatic or manual cycling.

Positive stop, either with dwell or



FAST ANGULAR INSPECTION SET-UPS

... with repetitive accuracy

You can save hours of set-up time and be certain of accuracy on all your angular inspections with Robbins Sine Plates.

Any desired angle (single or compound) can be quickly and easily set up by using standard gauge blocks. Referring to the handy table that is supplied with each unit, it is simple to select the proper blocks.

Robbins Sine Plates are made of hardened steel, built to commercial precision tolerances on the sine bar method. Gauging surfaces are ground and lapped with tapped holes in the top plate to clamp the work piece. Thousands are in daily use.

Get complete details on Sine Plates and other Robbins precision engineered products. Write for your free illustrated catalog and price list today.

OMER E. Robbins COMPANY

DEPT. E-3, 24800 PLYMOUTH RD. DETROIT 28, MICH.

Also producers of special gauges and fixtures

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NOW!
SEE THE
DIFFERENCE



in
HORTON
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New plastic demonstrators
show the advantages of
Horton's Famous Five Extras.

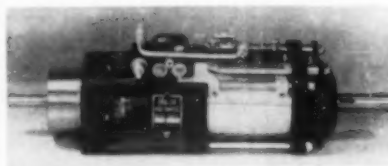
1. Exclusive pilot hole construction
2. Chrome nickel steel scroll heat-treated to 40-45 Rockwell C
3. Exclusive replaceable pinion bushings
4. Self-contained operating screws
5. One-piece body construction

Now you can SEE these built-in extras in actual operation. Ask your Horton Distributor NOW!

HORTON
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Windsor Locks, Conn.

INDICATE A-6-140



with instantaneous retract operation, continuous cycling, skip drilling, back feeding and manual jogging are all easily achieved.

Advance of 8.5 times and retract thrusts of 3 times are developed by air pressure with feed rates established by adjustable hydraulic controls. Feed rate advance is 0 to 240 ipm while retract is 0 to 100 ipm. The 2 1/4 x 3/4 inch diameter, keyed, pulley shaft mounts standards fixed or variable speed V-belt pulley drives.

T-6-1401

Die Blanks

Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 46, Wis., is offering a variety of stock die blanks for off-the-shelf delivery.

These stock die blanks are made of Ampco Metal Grade 24, a special copper-base alloy recognized for its quality drawing, forming, bending or wiping in die service without the necessity of heat treating.

Since dies of Ampco Grade 24 are widely used on press operations where stainless steel is being worked, the company suggests that the hold-down pads should also be made of this alloy to obtain the top efficiency.

The stock die blanks are available as solid rounds, rectangles and centrifugally cast rings.

The solid round sizes (as cast) range from 1 to 5 inches in diameter and in lengths of 6 to 12 1/2 inches. The rectangles (as cast) range from 1/2 to 4-inch thicknesses and from 1 to 4-inch widths, with lengths of 6 to 12 1/2 inches. The rough bored ID on the centrifugally cast rings range from 1 to 12 1/2 inches—the OD from 4 to 20 inches and the thickness from 1 1/2 to 3 1/2 inches. One face of the cast rings is machined.

T-6-1402

Steel Strapping Unit

A line of pneumatically powered tools for production line steel strapping applications, particularly where pre-determined, uniform tension is required, has been developed by Acme Steel Co., 2840 S. Archer Ave., Chicago 8, Ill.

Each strap is applied with exactly the same tension as the one preceding it. Friction type stretchers, designed

with rotary gripping dogs, will take up any amount of slack strapping. Strap tension can be changed by adjusting the air pressure regulator.

A wide variety of strapping jobs can be done by these simple to operate tools including the strapping of: protective wrappings for appliances; circular containers; packages; bundles, skids; and pallet loads. They will handle strap widths from 3/8 to 3/4 in. and strap thicknesses from 0.010 to 0.023 in. The stretchers range in weight from 5 1/2 to 9 1/2 lb.

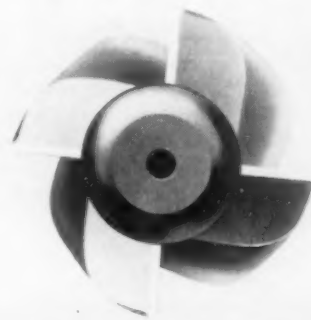
T-6-1403



Counterbore Design

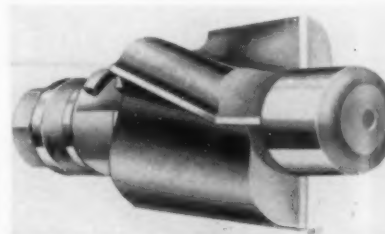
Eclipse Counterbore, 1600 Bonner Ave., Detroit 20, Mich., has announced an improved counterbore design affecting flute form. The development now incorporates features that offer deep counterboring with a wider range of pilot sizes; higher helix angle to give faster chip disposal; and teeth so constructed as to provide maximum heat dissipation.

T-6-1404



Above, end view shows flute form designed for spot facing and deep counterboring.

Below, side view pictures the increased helix angle which permits faster chip removal.



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Literature Number	COMPANY	DESCRIPTION
A-6-225	Allen Mfg. Co.	Setscrews—Bulletin C-33A points out the features of Allen setscrews. (Page 225)
A-6-208	American Broach & Machine Co.	Broaching Fixtures—American Circular 300 lists all the standard American Vertical Hydraulic Surface Broaching Machines. (Page 208)
A-6-165	Anker-Holth Div. of The Wellman Engineering Co.	Hydraulic Cylinders—Bulletin gives complete line of Anker-Holth products. (Page 165)
A-6-205	W. F. & John Barnes Co.	Special Machines—Booklet "Coordinated Machine Engineering" describes the scope of Barnes machine tool building service. Illustrates and describes modern machines and mass production techniques. (Pages 204-205)
A-6-240	Behr-Manning Corp., Div. of Norton Co.	Abrasive Tools—Booklet "Blueprints for Production" describes Behr-Manning abrasive tools and discusses applications. (Page 240)
A-6-33	The Cincinnati Shaper Co.	Shears—Catalog S-6 discusses Cincinnati Shears. (Page 33)
A-6-318-1	Comtor Co.	Internal Comparators—Bulletin 48 describes the Comtorplug and shows applications and advantages. (Page 318)
A-6-215	The Cushman Chuck Co.	Chucks—Data book 852 describes Cushman wheel and ring chucks. (Page 215)
A-6-181	Dearborn Gage Co. Ellstrom Standards Div.	Gage Blocks—New Standards catalog contains complete specification and prices in convenient tabular form. (Page 181)
A-6-180-1	Drillunit, Inc.	Hydraulic Drill Units—Catalog-folder and data sheets discuss dimensions, traverse rates, feed rates, and capacity of long-stroke drill units. (Page 180)
A-6-157	Eastman Kodak Co.	Contour Projectors—"The Kodak contour projector, Model 30," gives standards for large-screen projection gaging. (Page 157)
A-6-314	Erickson Tool Co.	Collet Chucks—Catalog K gives complete applications and advantages of Erickson holding tools. (Page 314)
A-6-329	Ex-Cell-O Corp. Continental Tool Works Div.	Broaches—The advantages of Continental broaches are discussed in "Cutting Tool Catalog." (Inside back cover)
A-6-15	Federal Products Corp.	Gages—Over 40 case studies of Federal gage users are covered in detail in Bulletin 72. (Pages 14-15)
A-6-267	Frauenthal Division Kaydon Engineering Corp.	Grinding Machines—Multiple-Head vertical grinders are described and production benefits given in Bulletin 301. (Pages 266-267)
A-6-149	Fray Machine Tool Co.	Milling Machines—Bulletin 10 gives details and specifications of Fray mills. (Page 149)
A-6-154	Gaertner Scientific Corp.	Optical Instruments—Bulletin 147-50 tells the complete story for toolmakers' microscopes. (Pages 154)
A-6-284	Giddings & Lewis Machine Tool Co. Davis Boring Tool Div.	Boring Equipment—Catalog 304 gives all facts concerning line of interchangeable boring parts. (Page 284)
A-6-17	Gisholt Machine Co.	Special Machine—Versatility of this machine is illustrated by 28 different jobs in the No. 12 hydraulic automatic lathe catalog. (Page 17)
A-6-20	Gisholt Machine Co.	Superfinishing Attachments—New catalog gives clear, concise explanation of the superfinishing process; reports on and illustrates numerous applications; and shows how time and money are saved. Gisholt also offers new general catalog. (Page 20)
A-6-172	George Gorton Machine Co.	Horizontal Mills—Bulletin 1655-2606 gives data on Gordon horizontal mills. (Page 172)
A-6-207	Greenfield Tap and Die Corp. Goemetric Tool Co. Div.	Adjustable Taps—Full details for geometric Class SJ solid adjustable tools are given in Bulletin SJ. (Page 207)
A-6-281	Hanna Engineering Works	Air and Hydraulic Cylinders—New "750" Fluid Power Cylinder Catalog discusses construction and advantages of Hanna cylinders. (Page 281)
A-6-232-1	The Hi-Shear Rivet Tool Co.	Drill Templates—Anchor Bushing catalog describes methods, bushing styles, sizes and prices. (Page 232)

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A-6-129	Howe & Fant, Inc.	Turret Drilling Machine—Bulletin 5403 gives complete description of new vertical drilling machine. (Page 129)
A-6-299	Illinois Tool Works	Fine Pitch Hobs—New literature gives complete new discussion of fine pitch hobs, including latest applicable standards with data on types, tolerances, performance and application. (Page 239)
A-6-231	The Ingersoll Milling Machine Co.	Face Mills—Catalog 60F describes Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters and boring heads. (Page 234)
A-6-236	Kearney & Trecker Corp.	Special Machinery—Data sheet 1002 and booklet "Doorway to a Proven Method for Solution of Big and Small Metalworking Problems" gives complete information concerning special machinery. (Page 236)
A-6-10	Latrobe Steel Co.	Die Steel—Olympic FM folder discusses the advantages of Latrobe die steels. (Page 10)
A-6-147	Lehmann Boring Tool Div. of Novo Engine Co.	Boring Tools—Technical tooling problems are discussed in catalog BT-12. (Page 14)
A-6-137	The Lincoln Electric Co.	Welding Machinery—New developments in automatic welding and cost reduction possibilities are discussed in bulletin 439. (Page 137)
A-6-269	Lodding, Inc.	Jig and Fixture Components—Catalog includes full-scale layouts of every Lodding fixture. (Page 269)
A-6-131	Melin Tool Co., Inc.	Live Centers—Catalog 54-C lists specifications, prices and complete line of Melin tools. (Page 131)
A-6-185	Modern Industrial Engineering Co.	Deburring and Chamfering Machines—Production advantages from Burr-Master machines are given in bulletin 103-81. (Page 185)
A-6-213	National Broach & Machine Co.	Gear Shavers—Bulletin S53-7 gives all details and developments. (Page 213)
A-6-30	C. A. Norgren Co.	Lubricating Systems—Norgren's Spray-Lube System is discussed in folder 491. (Page 30)
A-6-200	Peerless Production Co.	Production Equipment—Specialized production equipment of various types are discussed in 28-page catalog. (Page 209)
A-6-167	Pivot Punch & Die Corp.	Die Punches—Production increases are discussed in new catalog. (Page 167)
A-6-155	Reid Brothers Co., Inc.	Surface Grinders—Complete information on Reid Surface Grinders is contained in catalog 618-15. (Page 155)
A-6-23	Scully-Jones and Co.	Special Tools—The following bulletins are concerned with Scully-Jones tools: 20-50, 10-50, 2-50, and 19-50. (Pages 22-23)
A-6-160-1	Standard Parts Co.	Jig and Fixture Components—66-page catalog with 150 drawings gives new sizes and parts and advanced engineering features. (Page 160)
A-6-252	Sutton Tool Co.	Collets—Catalog 18 contains 26 pages of collet and feeder information and specifications. (Page 252)
A-6-268-1	Swanson Tool & Machine Products, Inc.	Turret Indexing Units—Bulletin TC4 describes new clutch-operated models of Swanson turret indexing units. (Page 268)
A-6-288	The Torrington Company	Swaging Machinery—Booklet gives complete information on swaging as a method of bonding or reducing metals. (Page 288)
A-6-273	Valvair Corporation	Solenoid Valves—Bulletin TE-6 enumerates the features which give users production advantages. (Page 273)
A-6-278	The Van Keuren Co.	Gage Blocks—"Van Keuren precision measuring tools," handbook 35, fully describes Van Keuren gage blocks. (Page 278)
A-6-248	Vascoloy-Ramet Corp.	Carbide Toolholders—Catalog DR-435 points out the various types of toolholders. (Page 248)
A-6-159	S. B. Whistler & Sons, Inc.	Dies—Illustrated catalog gives complete details, prices, and applications of the various adjustable, magnetic, custom and cam dies produced by Whistler & Sons. (Page 159)
A-6-6	Winter Brothers Co.	Taps—Catalog 20 lists all special application taps manufactured by Winter Brothers. (Pages 6-7)
A-6-304	The Yoder Co.	Rotary Slitters—Book contains information on mechanics, economics, operation, time studies, cost analyses, coil handling, scrap disposal and other useful data. (Page 304)

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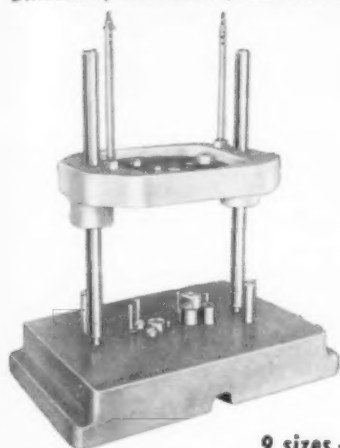
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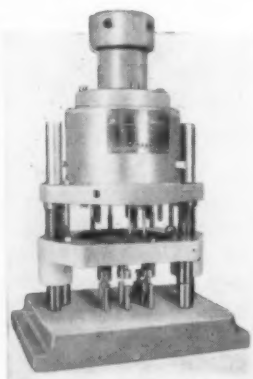
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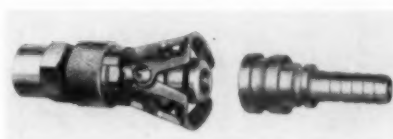
June 1954

Valve Coupling

With an eye toward giving the operator complete and safe control of the air line, at whatever point between the compressor and air operated device, C. B. Hunt & Son, Inc., Salem, Ohio has designed a valve coupling called Quick-As-Wink.

Nose piece of the jaw half of the coupling is provided with an O ring held in a machined groove. When the coupling is connected, the nose piece slides into the recess of the connection half of the coupling.

The joint is tightly sealed by the internal fluid pressure acting on the



O ring, but the two halves are able to swivel freely without leakage. The O ring is readily accessible and can be replaced easily and quickly without tools, when it becomes worn, without requiring any disassembly of the coupling.

The jaw or valve half of the coupling which is always connected to the live air supply line, is also provided with locking jaws and a brass sleeve. The sleeve can be moved back and forth over the hollow, radially ported stainless steel body, and is fitted on the inside with pressure sealing U-packers.

T-6-1431

Metal Cleaner

Phosphoric acid-type cleaners, intended mainly for products that are too large or heavy to be phosphate coated with normal production methods, and for manufacturers whose production does not warrant elaborate equipment for phosphate cleaning, has been developed by the Detrex Corp., 14331 Woodrow Wilson, Detroit 32, Mich.

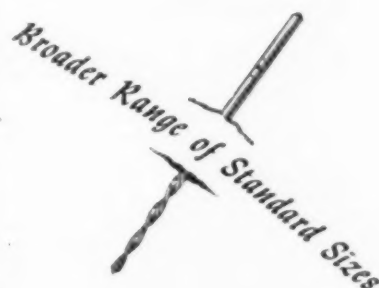
Called the 800 Series, this recent addition to the Detrex family of phosphate cleaners will be especially compounded to meet the particular requirements of each installation.

It can be applied by any practical method such as brush, sponge, dipping, or flowed-on, and can be specified to incorporate such properties as detergent, oil solvency, rust and scale removal.

The phosphoric acid-type cleaners provide two functions: in addition to removing rust, light scale, shop dirt and oil, as specified, it also deposits a fine-grained crystalline structure of iron



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phosphate that become chemically interlocked with the metal itself.

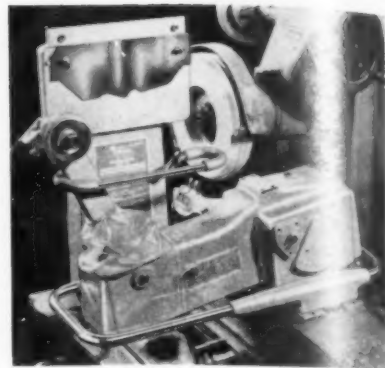
This coating contains millions of microscopic crevices into which paint flows and is securely locked. As a result, peeling and flaking is retarded, corrosion is prevented, and blistering due to corrosive action taking place under the paint film is avoided. **T-6-1472**

USE READER SERVICE CARD ON PAGE 141 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Wheel Forming Attachment

Now on the market is a medium sized Diaform wheel forming attachment made by Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

This latest addition to the Diaform family is designed to simplify the forming of grinding wheels up to 14 inches in diameter used for grinding dies, punches, flat or circular forming tools and similar forms. Offering a



quick, accurate method of truing a given form up to 2 inches wide and 1 inch deep in one setting, this Model No. 2 Diaform is similar in design to earlier Diaform units.

Basic construction is a vertical pantograph—operated by tracing a template to guide a truing diamond across the face of the grinding wheel on a 5-to-1 ratio.

The attachment is portable and may be placed on the magnetic chuck or strapped to the table of the grinder. Two diamonds mounted in tandem are used to true the grinding wheel: one for roughing, the other a finishing diamond. A centering gage is provided to center each diamond under the grinding wheel for its respective truing operation.

The P & W Diaform is made in both right hand Model No. 2A (for clockwise wheel rotation) and left hand Model No. 2B (for counterclockwise wheel rotation). **T-6-1442**

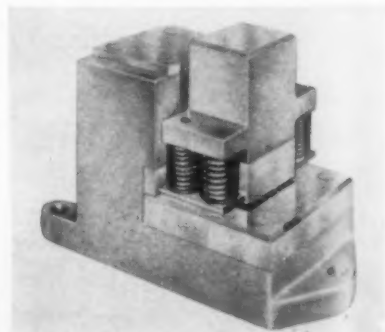
Notching Unit

Toolset, Div. of General Riveters, Inc., 777 Hertel Ave., Buffalo 7, N. Y., announces a line of notching units in both open and confined types.

They are self-contained, permanently aligned punches and dies which avoid need for attachments to the upper ram of the press.

As shown in the illustration, lifter springs, punch and die are contained in a single holder.

Units have shut height of 6 5/16



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inches and a die height of $2\frac{19}{32}$ inches. Dimensions identical with the company's line of Hole Piercing Units, therefore, both units can be used together without adjustment or shimming.

Punch sizes available in both the open and confined types are 2x2 inches, 3x3 inches and 5x5 inches. Standard notching units are available in corner 90 degree Vee and angle models. Special shapes can be made to order. **T-6-1451**

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Angle Saw

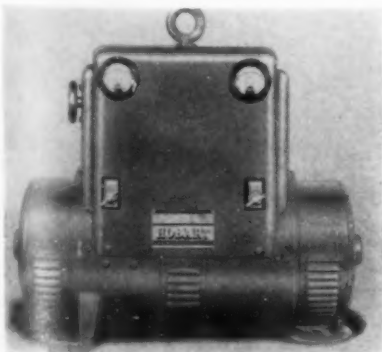
A compact Handy Angle saw that will cut intricate patterns in sheet metal and can be used on iron pipe as well as most other types of materials, is announced by Price & Rutzebeck, P.O. Box 30, Hayward, Calif.

The versatile tool operates on standard $\frac{1}{4}$ -inch electrical drills, geared at any speed from 1800 to 3500 rpm, mounting at a right angle to facilitate working in close quarters. Special blades, readily interchangeable and also reversible for right and left-hand users, are supplied—both the bayonet type for contour cutting and tapered type where rigidity is needed. As a further feature, the saw will cut its own starting hole.

Less than 7 inches long over-all including blade, the saw weighs less than $1\frac{1}{2}$ lb. **T-6-1452**

Constant Voltage D-C Arc Welder

Welding with inert-gas-shielded-arc, the submerged arc, and other automatic presses is the work for which a constant voltage d-c arc welder was designed by Hobart Brothers Co., Troy, Ohio. Desired arc voltage may be set by means of a handwheel on the side



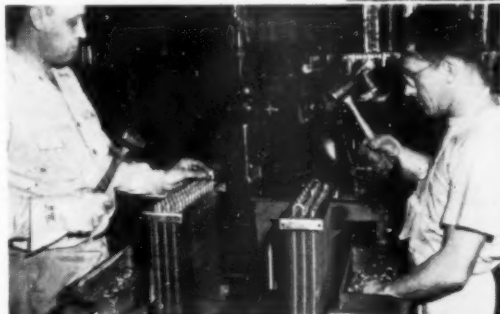
68 leak-proof joints in $2\frac{2}{3}$ minutes

SIL-FOS
brazing
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This job goes to prove once more that you can't beat the brazing of non-ferrous metals with the low-temperature silver alloy SIL-FOS. And it also shows what a simple matter it is to get fast, economical production with SIL-FOS. Brazing return bends on the condenser and the evaporator of the FEDDERS room airconditioner is the job—and here's how it's done.

Photos and data courtesy of Fedders-Quigan Corp., Buffalo, N. Y.

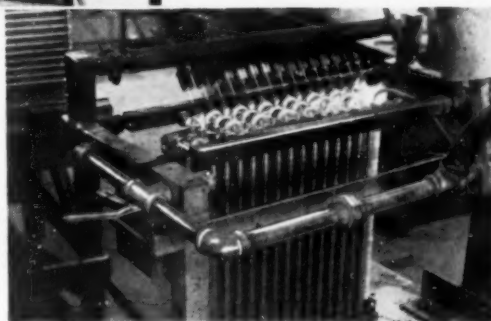
A SIL-FOS wire rings are placed on ends of return bends and positioned in the simple jig in lower left.



B Return bends with SIL-FOS rings in place are assembled on the tubes of the condenser.

C The 3 rows of return bends are brazed at one time in this simple gas-air burner set-up—40 joints in less than 1 minute.

Return bends on the evaporator are done the same way—28 joints in $1\frac{1}{2}$ minutes.



BULLETIN 20 tells how to get fast brazing production

It gives complete facts about low-temperature SIL-FOS brazing and goes into detail about good joint design and fast production brazing methods. Write for a copy today.



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of the control cabinet. The voltage remains constant regardless of the amount of current being used due to a separately excited design with sufficient compounding that provides a very high short-circuit current value. As soon as the welding wire strikes the work, a surge of current practically vaporizes the wire and establishes an arc immediately. Enough current then flows to cause the arc voltage to correspond to the preset generator voltage. When used with a process wherein the wire is fed continuously into the weld, the machine automatically controls the current by maintaining the voltage at the established value, regardless of changes in the speed at which the wire is fed to the arc.

The units are available in three rated capacities of 400, 600, and 900 amperes for operation on electric power supply voltage (dual) or for 550 volts (single). They can also be supplied for 50 cycles or 25 cycles, as well as for d-c current supply of 115 volts, 230 volts, or 550 volts.

T-6-1461

USE READER SERVICE CARD ON PAGE 141 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Knockout and Insert Pins

Ace Drill Corp., Adrian, Mich., announces a line of Long-Life knockout pins and insert pins for the cold heading industry.

Performance records on over 125 test applications showed increased pin life of from 200 to 700 percent without failure. Most favorable results were obtained where the ratio between length and diameter was greatest. No straightening or special heat treating operations are required.

Heat treating is performed in a continuous furnace designed expressly for high-speed steel which provides the pins, drills, reamers, etc., with top uniformity in heat treatment and imparts to them an excellent combination of toughness, hardness and strength. Diameters are ground after the hardening process.

The Long-Life pins have the equivalent toughness of conventional tool steel materials, yet measure about 6 points higher on the Rockwell C scale.

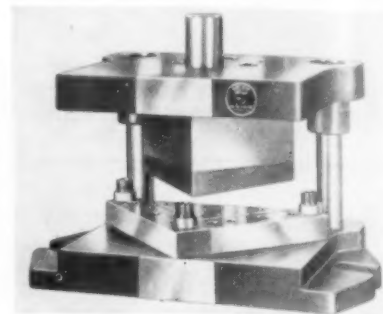
They can be supplied in either the headed or straight types, in diameters from 0.040 to 1.000 inch. Headed type pins are normally supplied with heads approximately 0.015 inch larger than the body diameter.

T-6-1462

Notching Unit

A precision tool for "V" notching angle iron to give a full 90-degree bend has been announced by Vogel Tool & Die Corp., 1807 N. 32nd Ave., Melrose Park, Ill. Consisting of punch, die and die set, the tool will notch angles up to and including 3 x 3 x 3/8 inches as well as flat stock of 3/8-inch thickness.

Notching action gives sharp, smooth



cuts with no deformation of stock. Finish grinding or filing is unnecessary.

The unit is available with or without liner pins. Special units in smaller sizes for use in hand or power presses are also available.

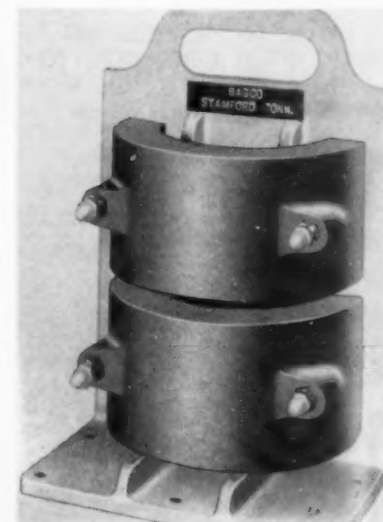
"V" Notcher illustrated measures approximately 7 1/4 inches high, 9 inches wide and 11 inches long and requires a minimum die space of 7 1/4 inches.

T-6-1463

Magnetic Separator

Automatic separation of steel plates up to 1/4 inch thick is possible with the heavy duty magnetic separator. The unit may be used to speed feeding into presses, shears and other metal fabricating machinery.

Stacks of plates up to 8 inches high can be handled, and it will separate round, square, nested or odd shapes



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round, square, nested or odd shapes with great facility. High polished or painted sheets and plates separate without damage.

Completely self-contained, the separator requires no outside connections. Permanence of the magnets is guaranteed for life.

Based on the magnetic characteristic that opposite poles repel, this separator induces a magnetic field in the stacked steel plates, causing the ends to fan out with air space between, regardless of coating or grease, so that the operator can grasp the top sheet easily.

Construction involves two extra heavy duty magnets mounted on a stainless steel reinforced aluminum mounting plate, 14 inches high x 9½ inches wide. The 5½-inch-wide base is drilled for bolting to a bench. In addition to the extra heavy duty model, Basco separators are supplied in various models for handling very thin stock, sheet of 32 gage and lighter, and sheets up to 12 gage.

T-6-1471

Live Bushings

J. G. Jergens Co., 11106 Avon Ave., Cleveland, Ohio, has introduced a line of roller bearing live bushings for piloting applications on various sizes and makes of boring mills.

By replacing the bronze bearings in the column supports of boring mills with the live bushings, greater rigidity with corresponding increases in precision and length of tool life is accom-



plished. In addition, they permit the use of carbide tools to their full capacity for heavier cuts at higher speeds.

Liners of the bushings rotate with the bars preventing scoring and wearing of expensive boring bars. Utilizing two sets of absolutely sealed, adjustable, precision tapered roller bearings, the Jergens live bushing assures constant rigidity and precision required for high production. These Jergens bushings are made to the maximum bar capacity of the boring mill, the bushings can be bushed down for precision adaption to any smaller size bar or combination of bars.

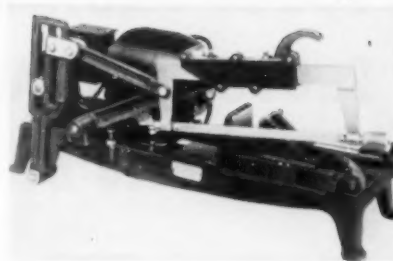
T-6-1472

Power Hacksaw

La-Roy Industries, Inc., 810 Fowler St., Howell, Mich., has introduced a portable power hacksaw suitable for both industrial and trade shop use for cutting steel, tool steel, channels, pipe, conduit, aluminum, brass and bronze.

Prime feature of the tool, known as The Dymond portable hacksaw, is its mechanical motion, which provides cutting action on the forward stroke of the blade and automatic lift and release of pressure on the return stroke. This action assures an accurate cool dry cut on any metal without the use of cooling compounds.

An automatic stop permits the operator to set the saw to the desired cut and attend to other work during

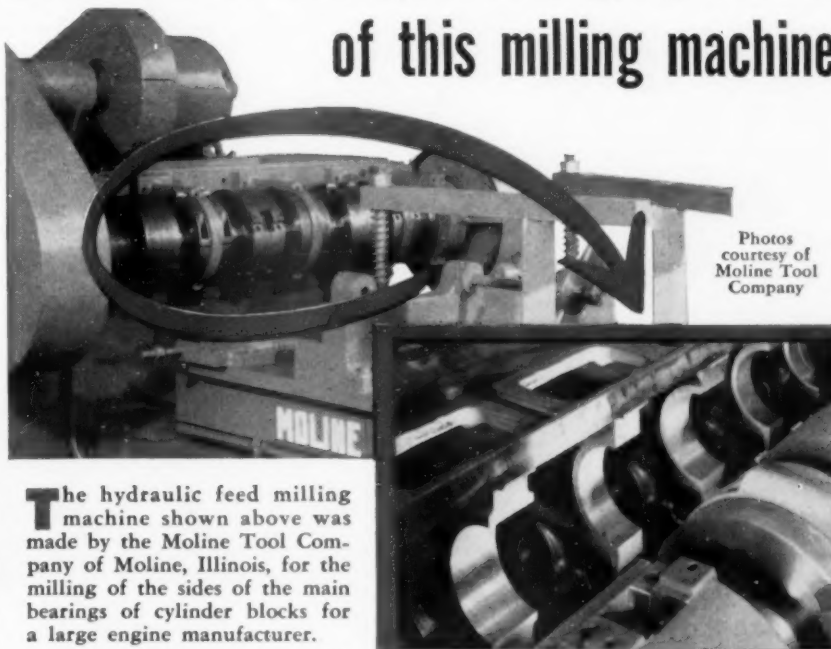


the cutting operation.

Other features include portability and the fact that it is a complete unit ready to operate. A quick action vise that holds stock up to 2¾ inches is easily adjusted to cut 15, 30 or 45-degree angles.

T-6-1473

Tools from LEHMANN BORING TOOL used in the multiple facing operation of this milling machine



Photos
courtesy of
Moline Tool
Company

The hydraulic feed milling machine shown above was made by the Moline Tool Company of Moline, Illinois, for the milling of the sides of the main bearings of cylinder blocks for a large engine manufacturer.

LEHMANN BORING TOOL furnished the precision bars, heads and tungsten carbide cutters circled above which machined the multiple straddle facing operation. The close-up view at the right shows the bottom of the cylinder block and the sides of the main bearings after milling.

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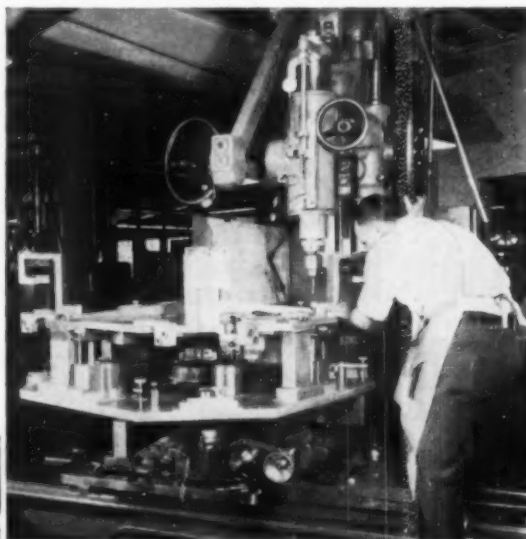
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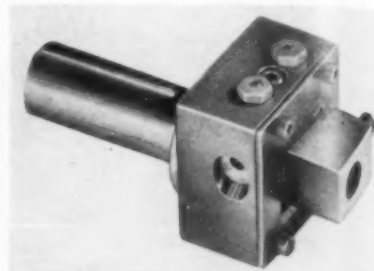
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Boring Head

Everede Tool Co., 2000 N. Parkside Ave., Chicago 39, Ill., is manufacturing a No. 1-50 boring head for use in automatic screw machines and small turret lathes. Either deep or shallow boring is made possible by lead screw placed off center so the bar length can be quickly and easily adjusted. Chatter and spring are minimized and necessity for various length bars is avoided. A calibrated dial on lead screw is divided



into 1/1000th's for accurate, on-the-spot adjustment of offset without calculations. Inexpensive, replaceable shanks make the No. 1-50 readily adaptable to various types of machines. Preformed high-speed steel triangular, preground, ready-to-use tool bits, provided on the boring bars, automatically provide clearance and rake angles, thereby reducing tool-bit grinding up to 75 percent. Tungsten carbide, stellite and tantum preformed triangular tool bits, also available, reduce tool-bit grinding and also save up to 75 percent on diamond wheel wear.

T-6-1481

Adjustable Speed Drive

Electronic Select-A-Spede, a stepless adjustable-speed drive, especially designed for applications where flexibility and close speed control are necessary, has been announced by the Louis Allis Co., Milwaukee, Wis. It operates from a-c power lines and is available with d-c drive motors in standard NEMA frame size, ¾ to 15 hp.

Speed ranges cover 5:1, 20:1, or 50:1, with 100:1 available for some applications. Speed regulation is especially precise. When the unit is used with optional tachometer feedback equipment the regulation will be $\pm 1\frac{1}{2}$ percent. Optional control features include inching, jogging, threading speeds, controlled acceleration and deceleration, dynamic braking, and reversing.

Further information about the Louis Allis Electronic Select-A-Spede is contained in bulletin No. 1500. * **T-6-1482**

Jig and Body Fixture

Standard jig and fixture bodies are offered by Smith Engineering & Tool Co., 150 Bay Ave., Glen Ridge, N. J., as the answer to lowering design and production costs on all tooling operations. These cast bodies, made with ground parallel sides and base plate, are available in 7,500 different stock sizes. Simply by adding jig feet to any side, they are easily adapted to most types of tumble fixtures problem.

The fixture is quickly converted to production tooling in half of the usual design and machining time. Unlike other standard fixture parts, the inexpensive Smith bodies come only one universal shape—finished on top, bottom and on all inside surfaces.

Their main time-saving advantage is that they conform to the usual tooling practices and require no change of operational procedure.

Complete range of sizes as follows: 1 to 12 inches long in 1/2-inch steps, 1 1/2 to 12 inches wide in 1/2-inch steps, 1 to 5 inches high in 1/4-inch steps. **T-6-1491**

USE READER SERVICE CARD ON PAGE 141 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Toolholder

Detroit Reamer Tool Co., 2830 E. Seven Mile Rd., Detroit 34, Mich., offers a toolholder of unusual design, called the Wej-Lok.

Of one piece construction, the holder barrel is accurately machined to not only hold cutting tools but also the several holder parts that prevent the tools from turning or coming out once they are locked in place. The rectangular wedge, located in the head portion of the holder, is moved back and forth in its channel by the retainer to either lock or unlock inserted tools. A keyed interlocking of retainer and knurled retainer ring causes these two parts to operate as a single unit. Thus, when retainer ring is revolved, the re-

tainer is simultaneously actuated and strikes the wedge to move it either to locking or unlocking position.

In locked position, the flat surface of the wedge is firmly seated in the mating notched section on shank of inserted tool. Normal torque of tool in operation tends to tighten this wedging action. The locking ring prevents the retainer ring turning loose due to vibration.

The slot in the face of the Wej-Lok holder permits the use of Baker drive on larger tools or where unusually heavy cutting operations are employed. By augmenting the wedge locking of tools with the Baker drive, torque stresses are distributed over the larger diameter of the holder face to further assure utmost stability and elimination of play. **T-6-1492**

Self-Locking Tap

A tap which produces self-locking internal threads and largely avoids use of bolts, nuts, lock nuts, cotter pins and locking wires has been invented by Shearcut Tool Co., 7045 Darby Ave., Reseda, Calif. Identified as the Shear-cut Ever-Lock taps, they produce locking torques in excess of any normal industrial requirements.

Manufactured to extremely close tolerances, they are produced in PG-II Tap Classes only, but are made to produce three classes of fits: snug, tight, and extra tight. Standard Go and Not-Go thread plug gages, Class III Fit, may be used for inspection. No special gages are required.

Self-locking actions permit standard cap screws to be used for the fasten-

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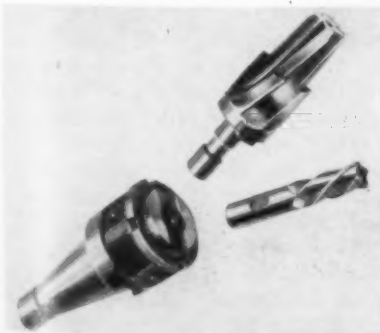
FRAY "ALL-ANGLE" HEAD TYPE 4



For deep, heavy cuts. Permits working to extra close limits. Any angle up to compound 2-way. Request Bulletin 4.



FRAY MACHINE TOOL CO.
 2935 NO. ONTARIO STREET, BURBANK, CALIFORNIA



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ing of parts together without bolts, lock washers, wires or other auxiliary devices.

With the self-locking threads produced by the Ever-Lock tap, standard cap screws either of the hexagonal, square or socket head type may be substituted for a bolt and the screw can be tightened to the proper degree for locking and holding by a power driven or hand operated torque wrench, insuring uniform locking and holding tension.

T-6-1501

Electroplating Rectifiers

A versatile line of electroplating rectifiers has been developed by Wagner Brothers, Inc., 400 Midland Ave., Detroit 3, Mich. The units are designed to accommodate any application requiring a positive source of continuously smooth d.c. current, at capacities from 5 to 50,000 amperes.

They are available in five basic models: large package unit, 2,000 to 50,000 amps; water cooled, 1,500 to 50,000 amps; small package unit, 250 to 2,000 amps; cubicle, to 2,000 amps; and bench type, 5 to 200 amps.

The rectifiers are conservatively rated, 3-phase circuit, selenium type rectifier stacks connected for 5 percent ripple, of unusually high efficiency and advanced design. Their compact, light-



weighted construction makes extra structural supports or foundations unnecessary. They can be connected in series, parallel, or series-parallel for practically any output of direct current power. All units are easily modified to meet particular requirements.

Associated regulators and controls of various types are also obtainable in standard or special designs.

T-6-1502



Choose Your Wrenches as you do your friends--for life

Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.

Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALLOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality.

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ARMSTRONG BROS. TOOL CO.

"The Tool Holder People" 5237 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

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Safety Vise

The deep jig jaw face is the outstanding feature of the Instant Change safety vise now available from Float Lock Corp., subsidiary of American Machine & Foundry Co., 511 Fifth Ave., New York 17, N. Y.

Little more than a touch on the hinged handle operates the screw jaw, either locking or releasing the work. The vise turns over on three sides, which allows drilling of many holes without removing the work. When quantities of the same thing are to be drilled, the vise may be locked securely like a drill jig at any position on the table. Positive anchoring avoids need of clamps, straps, bolts and washers. The tool holds all shapes and thicknesses of material securely.

As a consequence, the unit is very well suited to fast setups on production pieces; cutting to close tolerances; intricate cutting in safety since hands need not touch the material.

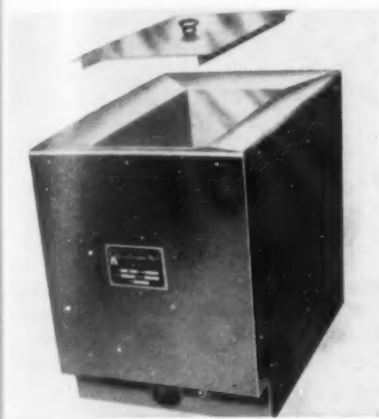
The vise jaws for band saws offer a maximum capacity of 10 inches. Parallel grooves align work for vertical cutting, while horizontal and vertical V grooves slign and grip rounds securely.

The tool, particularly for drill presses, has the same advantages and offers a maximum jaw capacity of 9 and 12 inches.

They may be used for vertical cutting, irregular shapes, compound angle work, hard-to-hold pieces or for automatic chain feed operation. **T-6-1503**

Plastic Melting Tank

Fast, uniform heating for top plastic dipping performance is offered by the Model 10 plastic melting tank made by Evens-Thompson Mfg. Co., P. O. Box 181, Center Line, Mich. Main feature of the tank is the all cast aluminum melt-



ing unit with inward pitched self-draining top that melts plastic faster. This top design avoids overflow and caking of plastic. Compact in design, the unit, which is practically maintenance free, measures 15x18x19 inches over-all. It has a 3.6-gallon dipping capacity, is easy to handle, simple to operate from all sides and has no obstructive protrusions.

T-6-1511

USE READER SERVICE CARD ON PAGE 141 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Shell and Face Mills

Shell end mills from 4 to 8 inches in diameter and face mills from 8 to 14 inches in diameter are available with Millit replaceable blades. Maximum tooth back-up of this blade's design makes possible a replaceable blade cutter with the same full tooth rigidity characteristics as solid body brazed on tip shell mills and face mills. Rake angles of the new cutters are built into the blade rather than determined by the body slot.

These cutters are available in extra wide stagger tooth widths for face milling finish cuts requiring a square corner with a high shoulder. The Millit extended width construction avoids long sections of carbide which may cause carbide breakage. As thermal expansion rate of carbide is roughly half that of steel, brazing strains, induced in the carbide tip as it cools, are proportional to the length of the carbide

section. By staggering blades across the width of the cutter the Millit extended width design avoids long blades and greatly reduces normal carbide cutter breakage of this type.

Blades are also available with carbide, H.S.S. or cast alloy cutting tips, enabling the user to convert a carbide face mill into a high-speed steel face mill by a simple change of blades.

Further information can be obtained from Millit, Inc., 47 Flint St., Rochester 8, N. Y.

T-6-1512

Adjustable Torque Driver

A tap driver, featuring adjustable torque and a full-releasing roller drive, is announced by Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill.

Design of the tool utilizes a new application of the roller-drive principle, permitting release without friction, heat or wear. Drive consists of drive shell, two rollers, and an inner cam drive collet. Torque is transmitted when the rollers are wedged between drive shell and cams on drive collet. When driving torque exceeds the preset limit, which is based on tap strength, the drive shell expands, permitting the rollers to enter a cylindrical portion, releasing the drive. As long as the ma-

chine spindle continues to rotate, the driver revolves in the released position on anti-friction ball bearings.

Five settings on standard drivers permit adjustment of the torque so that release occurs within a certain per-



centage of the breaking point, depending on job conditions.

Another important feature is the tool's ability to operate at maximum speeds when bottoming. A spring loaded centering plug behind the collet permits the machine spindle to advance slightly after the roller-drive releases, absorbing the shock when a tap hits the bottom of the hole. The op-

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Made of close grain, stabilized Chrome-Moly alloy to guarantee precision results every time. The exclusive new FROZONE process, for hardness and stability, makes UNI-V-BLOCKS the closest thing to absolute perfection, on the market today!

Shown here is MODEL No. 3000 (2 1/2 x 3 3/4 x 2 1/4")

UNI-V-BLOCKS are also available as:

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MODEL 1250 (1 1/4 x 1 1/4 x 1 1/4")



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- Consistent quality—rigid inspection.
- Tailor-made to exact length—NO SCRAP.
- Prompt delivery from local Distributor's stock.

erator can bottom tap at high speeds without fear of breaking taps.

Three standard assemblies are available for $\frac{1}{8}$ to $\frac{1}{4}$ inch, $\frac{5}{16}$ to $\frac{3}{8}$ inch and $\frac{1}{2}$ to $\frac{5}{8}$ -inch tapping ranges. Torque settings range from 55 to 660 inch lbs. Small diameters, $1\frac{1}{2}$ and $2\frac{1}{2}$ inches, permit use on close center work. Drivers may be used for tapping on radial drills, horizontal boring mills, multiple-spindle drills and other machines having a reversing spindle.

T-6-1521

Press Improvements

Three features were displayed at the ASTE Philadelphia exposition by Sales Service Machine Tool Co., St. Paul, Minn. which are being added to the No. 0 5-ton Press-Rite presses. Now all No. 0 Press-Rite presses will have heavy duty



bronze bushings in the fly-wheel, heavy bronze wear plates in the ramway, and a heavy duty clutch.

The No. 0 press, smallest of the Press-Rite line which ranges from 5 ton to 85 ton, has most of the heavy construction features of the heavier members of the line, including high tensile alloy cast reinforced frame, single stroke safety mechanism, and knock-out bar in slide.

T-6-1522

Shock Resistant Valve

A gasket mounted, solenoid operated, 4-way valve, that is fully shock resistant, has been developed by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. Scalloped design of the valve spool, which opens or closes gradually, increasing or decreasing areas to the ports as the spool is moved left or right, is the feature that eliminates impact and shock.

Metering grooves built into the

spool, as a choke block assembly to control the speed of the spool, aid in allowing the flow to enter and leave the valve with an easier, smoother action, and permit use of the valve as a decompression valve and a 4-way valve in one.

Series 6600 valve is designed for 3000 psi oil hydraulic service and meets all JIC requirements. Two basic valves can be used for five sizes: by merely changing pipe tap size the 1 inch valve may be used for 1/2, 3/4 or 1 inch IPS, and the 1 1/2-inch valve for 1 1/4 and 1 1/2.

The pilot valve may be used as a direct solenoid valve by itself for control of 3000 psi. It is furnished in 1/4-inch size and operates at 3.6 GPM at 15 ft. per second.

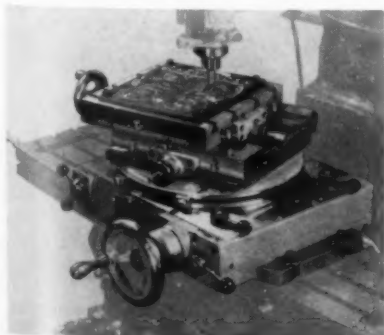
Four standard models are offered: double solenoid, standard action; double solenoid, spring centered; single solenoid, spring return; and single solenoid, spring centered. **T-6-1531**

Tool and Die Table

Savings in setup time are a prime advantage offered by the rotary type tool and die table designed by Advance Products, Benton Harbor, Mich. According to the manufacturer, setup time may be cut from 50 percent on simple jobs to as much as 90 percent on more complex jobs. Dimensions of the tool and die table, which may be attached to most standard and vertical milling machines, are 9 inches high over-all, 20 1/2 inches wide at the base, 18 3/4 inches deep (less hand wheel), and weighs approximately 325 lb.

In actual use, the workpiece is located and clamped on the 11 inch square top cross slide, and is never moved until all work has been completed—regardless of the number of operations, radii, angles, etc., to be cut.

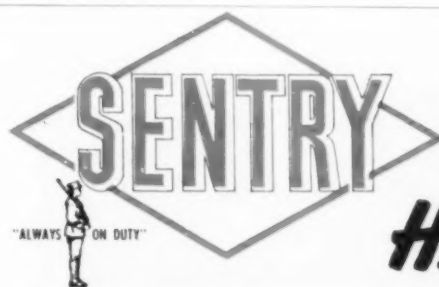
Illustrated is a demonstration plate on which there are over fifty different radii, in addition to all the angular cuts, which were milled with work retained in its original position on the cross slide.



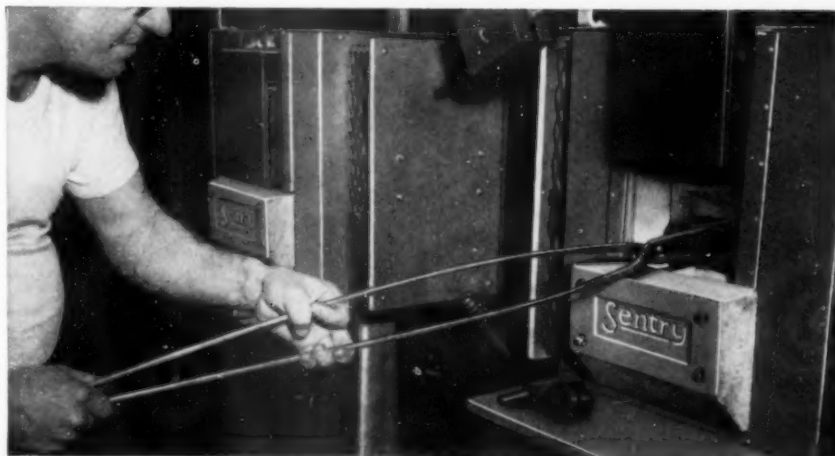
The rotating portion of the table may be turned by a worm shaft hand wheel, the collar of which is graduated in minutes. This worm shaft may be quickly disengaged, allowing table to be turned freely by hand, as an aid in locating the workpiece. A noninfluencing, expansion type brake and lock serves to hold the table rigid or as a back lash eliminator for climb cuts. Rotational stops are provided, which can be clamped at any point on the periphery of the rotating member, rotation being stopped by contact with a stop block which swings out of the way when not needed. **T-6-1532**

Segmental Chuck

A plate type chuck introduced by The Whiton Machine Co., New London, Conn., is designed so that jaw slots are formed in separate segmented plates which are subsequently mounted on the chuck's body. With this component it is possible to harden and finish grind the jaw slot's sliding surfaces before assembly. A very precise fit can be maintained between the jaw and the slot to provide great strength, rigidity and accuracy in the chuck. The segmental plates may be mounted on a heat treated steel body, a body of ductile iron or



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FOR
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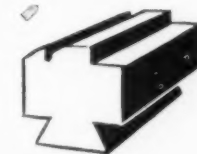


H.S.S. Heat Treating at New Britain Requires Accuracy

That's why they rely on Sentry Model Y electric Furnaces (see above) with the renowned Sentry Diamond Block atmosphere control. At the Screw Machine Products Division of the New Britain Machine Co., New Britain, Conn., they heat treat form tools, counter bores, reamers, gauges and fixtures, all of which must be completely free of decarburization and oxidation. Only Sentry is "Always on Duty" to guarantee this high performance.

Request Catalog N-45

For optimum hardness with complete protection against scale or decarburization, heat treat H.S. steels with Sentry Model "Y" Furnaces and Sentry Diamond Blocks.



This dovetail form tool must be perfect. The heat treating must be perfect also.

* High Speed Steel



Illustrates and describes all sizes of Models Y and YP Furnaces and The Sentry Diamond Block Method

THE SENTRY COMPANY
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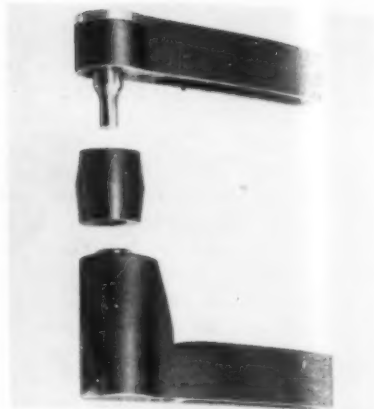
bodies made from aluminum alloy. The last-named body is intended for use in high-speed turning operations and is said to help reduce WR 2 factors.

They are offered in both independent and geared scroll models. An outstanding feature of the former lies in a full circle thrust bearing which is locked into position within the chuck body by the segmental plate face.

Construction features of the scroll type chuck include hardening and grinding of both the scroll bearing surface and the spindle mounting section which is applied to the American Standard spindle nose. **T-6-1541**

Retainers

Most recent addition to the R-B retainer line of Allied Products Corp., Richard Brothers Punch Div., 1560 E. Milwaukee Ave., Detroit 11, Mich., is especially suitable for short production runs on light gage metals and where die cost is a greater factor than usual. They are easily adjusted to any desired position on T slotted or drilled and tapped commercial die sets. Stripping is accomplished with rubber strippers or rubber covered springs rather than metal strippers, retainer screws and springs.



Standardized R-B punches and die buttons of standard shapes (round, square or oblong) or special shapes to customer specifications are used in these retainers. For, each retainer is furnished with the famous R-B ball lock that provides positive locking and automatic alignment of punches and die buttons.

Retainers are available for R-B punch shank diameters of $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$ and 1 inch; and die button outside diameters of $\frac{5}{8}$, $\frac{7}{8}$, $1\frac{1}{4}$ and $1\frac{3}{4}$ inch.

T-6-1542

Gaertner OPTICAL INSTRUMENTATION TO INSURE UNIFORM, ACCURATE PRODUCTION PARTS USE THE GAERTNER TOOLMAKERS' MICROSCOPE TO CHECK TOOLS, DIES AND GAGES



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GAERTNER TOOLMAKERS' MICROSCOPE
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2x4 inch Coordinate Measurement
Direct Reading to .0001 inches
Bulletin 147-50 tells the story in detail

THE GAERTNER SCIENTIFIC CORPORATION

1241 Wrightwood Avenue

Chicago 14, Illinois

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Cam Clutch Units

A line of cam-type, one-way clutch units designed to serve as backstop, indexing and overrunning clutches in a wide variety of machine drives is announced by Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. Known as 200 Series, these units are made with OD dimensions and tolerances corresponding to seven sizes of standard 200 Series ball bearings.

These cam clutches are unit assemblies consisting of a hardened steel outer race, hardened ball bearing steel full complement cams, two steel energizing springs, two spring steel thrust washers and two soft steel retaining plates.

The cam elements are designed specifically to meet the needs of all three types of one-way clutch applications.



They have constant pitch spacing that avoids possibility of the cams crowding into one side of the clutch. The shape of the cams prevents roll-over because of over loads or peak torsional loads. A flat contour on the cam surfaces beyond the locking position contacts the outer race at above-normal loads and prevents the cams from rolling beyond their contact point.

On multiple speed drives where two power units drive a common load, Morse cam clutches can be installed to automatically disengage the low speed unit when the high-speed unit is engaged.

T-6-1551

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Locking Chuck

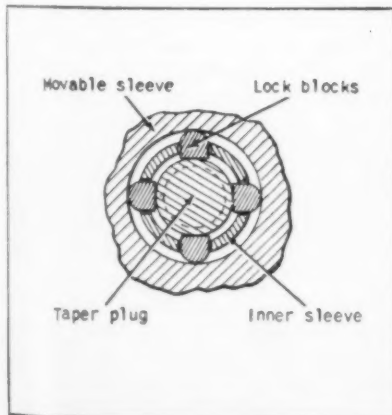
Safety factors provide outstanding features of the new P.R.O. (Power Release Only) chuck which will be given its first public showing by The Logansport Machine Co., Logansport, Ind., at the ASTE Show in Philadelphia.

The chuck will remain locked in closed position until it is positively opened by the operator. Neither centrifugal force nor power failure will cause release of the work as the chuck is revolving on the machine spindle. The body of the chuck is slotted radially to accommodate the jaws, which are moved in a radial direction by means of bell cranks.

Sleeve of the attachment is moved by the draw stud, acting through a set of locking blocks. These blocks are inserted in holes in a small inner sleeve and lock as a result of wedging against a tapered plug placed inside the movable sleeve.

The tapered plug is one-half that of the movable sleeve so that the blocks are wedged until they are positively released by the draw stud.

T-6-1552



Quick-C-Clamp

A simple C-clamp with pressure screw that quickly adjusts in length has been developed by Techno Products, Inc., 1908 E. 66th St., Cleveland, Ohio. The Quick-C-Clamp has no ratchets or springs to get out of order.

A quarter turn in either direction releases the pressure screw assembly so that it slides freely in and out of the threaded hub. In this way the disengaged pressure screw assembly can be positioned against the work, re-engaged and tightened in the usual manner. A

sliding thumb lock holds the pressure screw assembly in engaged position. This unique adjustable action is accomplished by having two sides of the outer barrel milled flat to match corresponding grooves in the ID thread of the hub.

Several advantages are incorporated in the clamp design: it can be adjusted quickly and easily around odd-shaped pieces. Sturdy construction resists the sideward deflection of the screw. Special, deep-throat design offers unusual strength. The entire length of the pressure screw is quickly available. **T-6-1553**

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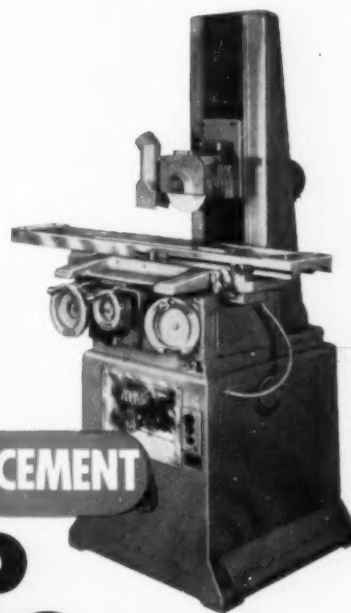
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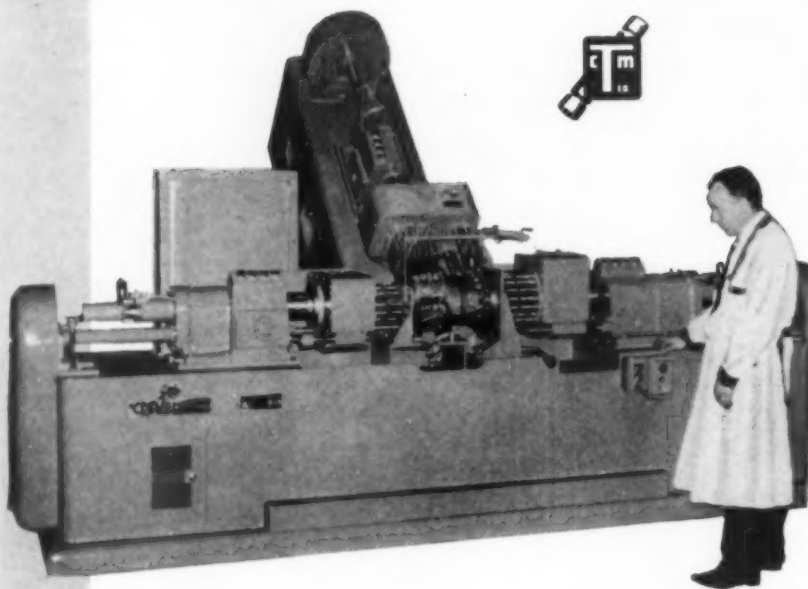
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3-WAY HORIZONTAL TAPPING MACHINE

OPERATION: Tapping 48 holes in crankcase.
Tapping time (48 holes) 7.9 seconds.

DESCRIPTION: A Cleveland Three Way Horizontal Tapping Machine with two F-2 Cleveland Tapping Heads opposed at each side and one F-2 head at 45° up at the rear with multiple heads on each head to suit the part. The right hand tapping head has a multiple head with 18 spindles; the left hand tapping head has a multiple head with 12 spindles; the rear vertical unit has a multiple head with 20 spindles.

The operator loads part into position between the tap guard plates and then moves the lever to the closed position and starts the machine. All heads tap simultaneously.

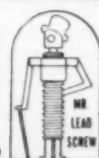


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Abstracts of Foreign Literature

By M. Kronenberg

Ceramic Tipped Cutting Tools

Properties which the tool engineer looks for in his tool tips include hardness, wear resistance at high operating temperatures and shock resistance. Most of these qualities are combined in an aluminum oxide material containing silica and alkaline metal oxides. Such a composition was patented in Great Britain as far back as 1912, according to a paper presented by K. J. B. Wolfe at the 5th International Mechanical Engineering Congress held at Turin, Italy, October, 1953.

Recently, by adding a small quantity of chromium oxide, the material was improved. This makes possible use of the aluminum oxide alloys in the form of ceramic tipped cutting tools for machining steel as well as light metals and plastics. The author reports that the Russians are also apparently using sinter alumina in a fairly extensive manner as a cutting tool material for machining steel.

When machining aluminum it may be concluded that built-up edges will develop on the tool due to the affinity of the aluminum in the tips with aluminum workpieces. It is therefore recommended that the tips be lubricated when machining light metals. This is unnecessary when machining steel because built-up edges do not develop.

The surface of the workpiece is superior when built-up edges are absent and it is claimed by the author that the high surface finish obtained with ceramic tipped tools on steel is due to this fact. The coefficient of expansion of ceramic tips compares favorably with that of carbides. In fact, the difference in expansion between the ceramic tip and steel shank is less than with a carbide tip. The problem of impact loads still exists with the ceramic tipped cutting tools, however, due to their low modulus of rupture.

The tests discussed by the author include the machining of clutch lining material with a ceramic tipped milling cutter, turning of prefired ceramic insulator components, turning of L-graphite,

of aluminum pistons and of NE8650 steel at 300 fpm cutting speed and feed rates between 0.001 and 0.010 ipr. Rigid design of the lathe and freedom from vibration is a prerequisite of successful application of ceramic tipped tools in single point machining operations on steel.

The author indicates that the addition of powder metals to the ceramic compact might give more metallic toughness to the tool tip. Although the technical difficulties are great in the production of such combination tips, it may be possible to overcome them and to open a new era of high-speed cutting.

Induction Heating for Stress Relieving Seams

An interesting method for stress relieving of large pipes by induction heating is described by F. Seiffe in No. 3, 1954 of *Werkstatt und Betrieb*. These pipes were a part of a water supply system for a hydroelectric plant and had to be welded to accommodate valves and other equipment. The stresses set up in the pipes were high and a method was needed to relieve them in order to preclude bursting or cracking.

The author discusses these problems from the standpoint of the production engineer. He presents diagrams for frequency, wiring system, number of windings and the calculation of the time required for the induction heating. The conclusion is that the induction heating method was the least costly of methods considered and also it permitted a good temperature control. In addition, the wrapping of the wires around the pipes required no essential space. The article concludes that similar methods could also be employed in other cases where limited space must be taken into consideration.

Investment Casting

The development of investment casting methods in Germany in recent years is the topic of an article by G. Lieby in the March issue of *Werkstatt und Betrieb*. Included is a short explanation of the method and reference to the specifications of the metals used. The author also describes limits for weights and dimensions and suitable shapes for investment casting parts.

The size accuracy of bores, holes, slots teeth and threads is discussed and several methods for obtaining improved surface finish are described. In addition, an investigation of improvements in corrosion resistance and appearance is discussed.

Numerous examples taken from the automotive and machine-building industries are given. The author also



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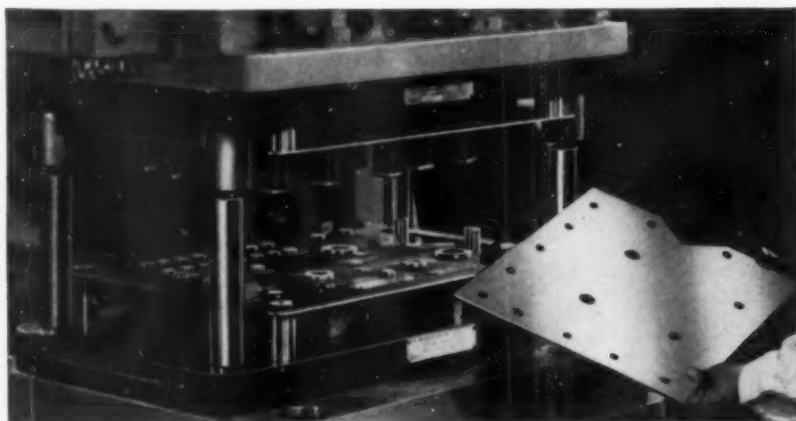
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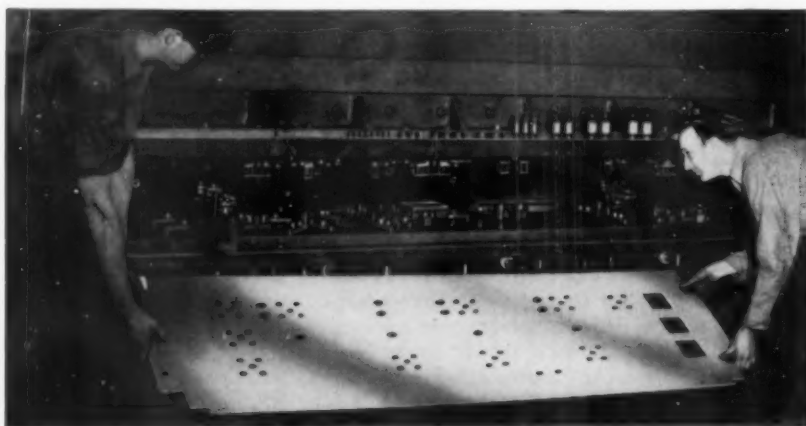
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Whistler MAGNETIC Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



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presents calculations for determining the smallest lot size where investment casting is economical and concludes that it is inadvisable to base cost calculations on a weight basis because the cost for parts of same weight varies, depending on the shape, wall thickness and other items.

Honing of Long Holes

Extensive research has been carried out at the Brunswick Institute of Technology covering the improvements in accuracy that can be obtained by honing deep holes, according to a report by G. Pahlitzsch and H. G. Schrader in the March issue of *Werkstattstechnik und Maschinenbau*. A deep hole is a bore where the ratio of length to diameter lies between 40 and 100:1. The authors' investigations covered workpieces up to 50 feet length using horizontal honing machines where the honing tool was rotated in a direction opposite to that of the workpiece. In this way it was possible to employ relatively low spindle speeds for the tool. Several coolants were compared. Those free of sulphur and chlorine gave best performance.

The investigation covered: the effect of the hardness and grain size of the honing tool on accuracy and tool life; the effect of the pressure between hone and surface of the bore; the effect of the cutting speed; and the degree of overlapping motion of tool and workpiece. The results are summarized in a nomograph having as one axis the diameter of the bore and on the other the recommended rpm for both tool spindle and workpiece. In the center of this chart, plotted on log-log paper, straight lines are shown indicating the various conditions which should be taken into consideration when selecting spindle and workpiece speeds for a given feed rate in order to obtain optimum conditions.

Officials of the recently formed Brassinter S. A. in Sao Paulo, Brazil, are in the United States to study processes and manufacturing methods of Firth Sterling which are involved with production of sintered tungsten carbide and tool steels. The Brazilian company is to eventually become the counterpart of Firth Sterling in that country, and purpose of the present visit is purchase of equipment necessary for installation of manufacturing facilities. Production facilities are to be set up as soon as possible, first on carbides then on steel, based on Firth Sterling techniques. Ultimately, output is expected to meet Brazilian demand for cutting tools and dies.

Field Notes...

In the light of the extensive titanium activity throughout the world, Sam Tour & Co., Inc. has created a Titanium Analysis Section. The company's four years of work under research and development contracts from the Army Ordnance, involving lengthy studies and many laboratory trials has afforded it broad experience in finding and developing satisfactory methods for the chemical analysis of titanium metal and alloys. As a result, the company feels in a position to handle requests for routine and control analyses for a large number of elements in titanium metal and alloys.

new operations

Announcement has been made of the formation of the Waldick Engineering Co. by Walter H. Dickman to represent manufacturers of aviation and industrial products on the east coast. The office is located in Garden City, N.Y. Mr. Dickman was one of the founders of Mineola Aircraft Engineering Co.

V V V

Two new operating divisions are to be established by the Pennsylvania Salt Mfg. Co., according to announcement by the company's president, George B. Beitzel, in order to provide more logical product grouping, better customer service and a suitable pattern of organization for expected future growth. Both units, the Industrial Chemicals and the Chemical Specialties Divs., will function as complete operating entities, responsible for manufacture and sale of their respective products. William P. Drake, vice-president in charge of sales was named president of the Industrial Chemicals Div., and Albert H. Clem, general sales manager is president of the Chemical Specialties Div. William F. Mitchell, formerly head of Pennsalt's manufacturing activities, is now president in charge of engineering, purchasing and traffic for the consolidated company.

V V V

James R. Longwell has retired from Carboly Dept. of General Electric Co., where he has been assistant to the gen-

eral manager, and has formed Longwell Engineering-Sales Co. The new firm will act as engineering and sales consultants and also be sales representatives for several manufacturers of industrial equipment, including the newly-formed organization, P. L. Kuzmick Co., diamond grinding wheel manufacturers.


V V V

Columbia Machinery & Supply Co. has been formed by Edward T. Hutton, former district sales manager of the

Delta Power Tool Div. of Rockwell Mfg. Co. The company, which has opened offices and show room at 606 Weyman Rd., Caste Village, Whitehall, Pittsburgh, Pa., will specialize in sales and services of light machinery tools, wood-working machinery, portable power tools and allied shop equipment. Mr. Hutton is a member of ASTE's Pittsburgh chapter.

acquired rights

Expansion of its power tool manufacturing operations into the low-priced electric tool market has been accomplished by Thor Power Tool Co. with its purchase of Speedway Manufacturing Co. The newly acquired firm will continue with the same personnel, un-



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MONTREAL
Humphrey B. Walton

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der the same executive management, operating as the Speedway Mfg. Div. of Thor Power Tool Co. The entire Speedway line will be marketed as Thor Speed Tools.

V V V

Manufacturing rights to the Weld-a-Matic splicer have been acquired from the dissolved Arms-Franklin Corp. by the Rolling Mill Div. of E. W. Bliss Co. According to the announcement of the transaction, the agreement transfers to Bliss patent rights, engineering drawings, service, operating and empirical data.

expansions

Construction of its new \$75,000 building is reaching completion for Aviation Developments, Inc. This facility at 210 S. Victory Blvd., Burbank, Calif., marks the company's second expansion in five years.

V V V

Open house and a machine tool show marked the completion for Fuchs Machinery & Supply Co. of the new plant and facilities at 2401 N. 11th St., Omaha, Neb.

V V V

Stanford Research Institute has started operations of its Pacific Northwest Div. with the establishment of an office in Portland, Ore. Through this office, located in the Equitable Bldg., the Institute anticipates carrying out a research program on problems of long range development of power and water resources of the Pacific Northwest. Manager of the Portland office is Patrick M. Dowling, a specialist in area development research and formerly assistant to the director of international research at SRI.

V V V

Production facilities for the Robertshaw-Fulton Controls Co. are being expanded with the opening of a new plant at Indiana, Pa. The one-story building provides 70,000 square feet of space adaptable to many types of manufacturing. W. D. Miller, assistant vice-president of Robertshaw-Fulton and general manager of the Robertshaw Thermostat Div. is in charge of the plant.

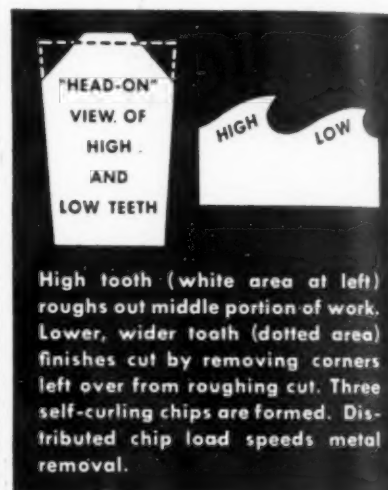
V V V

Full operation is under way at the first production unit of the new Chemical Products Plant of Aluminum Co. of America, and already shipments are being made from it on a routine basis. This is the first unit of a scheduled four. The second is expected to reach com-

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The Tool Engineer

pleted immediately. The four groups of chemicals to be produced are Hydrated Aluminas, C-30 series; specially calcined aluminas; ground and blended special aluminas and tabular aluminas.

V V V

Recent announcement from Hy-Pro Tool Co. made public completion of plans for an approximate 50 percent increase in the company's manufacturing area. According to the report, most of the space will house tap machinery and equipment now being manufactured especially for the New Bedford plant.

new offices

Executive and sales headquarters at the Newark, N.J., plant of Federal Electric Products Co. have just been completed. This expansion makes the entire first floor of the facility available to manufacturing operations carried on at the plant, and results in increased efficiency.

V V V

Quarters for the Joseph A. Battle Co. have been moved from New York City to 47 Hillside Ave., Manhasset, N.Y. The firm represents Size Control Co., Div. of American Gage and Machine Co.

V V V

Surface Combustion Corp. has moved its Chicago Industrial Furnace Div. office from the Park Ridge Federal Bank Bldg., to 116 So. Prospect in Park Ridge, Ill. It is expected that the larger quarters will permit increased manpower to better serve this area.

V V V

All facilities of the Tempil Corp. have been consolidated at 132 W. 22nd St., New York, N.Y., where only the plant and laboratory have been located previously. The move provides the necessary additional space needed for the firm's growing requirements.

V V V

The Cleveland office of Leeds & Northrup Co. has been moved to 1922 E. 107th St. The change in location offers the firm 50 percent more space than formerly and affords better facilities for its various functions.

V V V

Operation is now under way in the new building recently completed for Jones-Shipman (Canada) Ltd. The office and facility, which involves offices, showroom and service depot, is located

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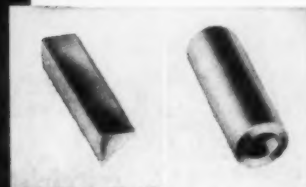
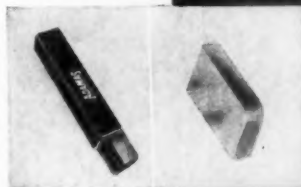
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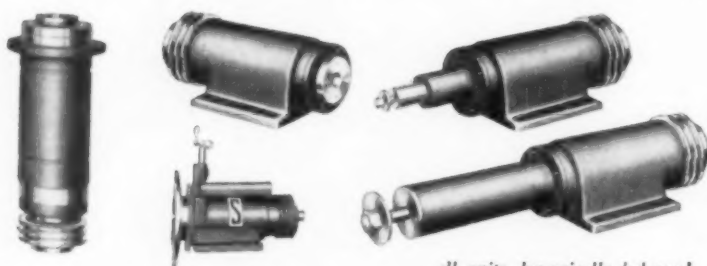
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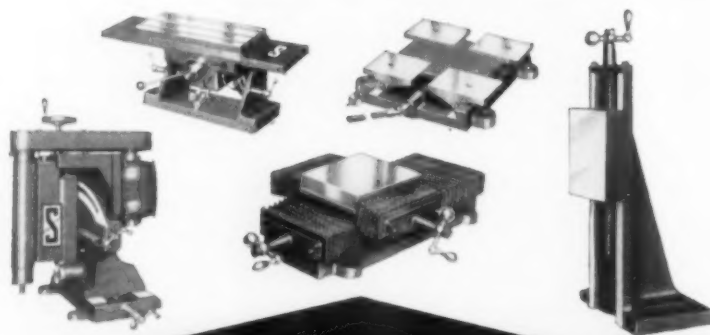
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at Ville LaSalle, Montreal, Canada. Its general manager and director is F. Brian Farndale, who has 20 years' practical and technical experience in the machine tool industry, with specialized knowledge of production and toolroom grinding problems.

V V V

Scoville Manufacturing Co. has moved its Rochester, N. Y., sales and service offices to 175 Dodge St.

V V V

With the move to its new Detroit office at 19372 James Couzens Hwy., Scully-Jones and Company is able to carry more complete stocks to accommodate customers and stocking distributors in the area.

broadened facilities

Most recent addition in the series of expansion moves which will involve a \$1,000,000, has now been dedicated by The Permutit Co. This unit, a modern metalworking plant costing approximately \$750,000, is considered the first step toward a complete industrial center in Lancaster, Pa. for the manufacture of several of the company's products.

V V V

A factory and office building for the Die-Casting Div. of Martin-Ruegg Brass and Aluminum Foundry is now under construction in Gardena, Calif. Custom molding and die casting for all types of metals industries will be done at this plant, where installation of the latest in equipment will assure highest quality work.

V V V

Production capacity of American Electro Products, originator of the Cantavone electroplating processes and techniques, has been more than doubled as a consequence of completion of a new wing to its plant.

V V V

Permanent mold facilities of the Rolle Manufacturing Co. have been considerably expanded giving that company a major increase in plant area allocated to that phase of its operations.

V V V

Fourth expansion of its facilities in the same number of years has been announced by National Carbide Die Co. The recent addition will be used primarily for fabricating of tungsten carbide deep draw dies.

The Tool Engineer

Technical Shorts...

Research On Cutting Brass

STUDIES WHICH its research laboratories have conducted on machinability of free-cutting brass as compared to leaded steel have now been revealed by Titan Metal Mfg. Co. The extensive, closely controlled research laboratory tests on the two materials included comparisons during six-month production runs manufacturing booster bodies out of each metal.

As a consequence, the experimenters were able to draw many overall comparisons, such as variation of manufacturing costs when leaded steel is substituted for free-cutting brass as the basic production material, factors of machinability, differences in tool down time and tool replacement, product quality and production rates.

Results of the work are reported in an interesting, illustrated booklet, "First Report: The Machining Characteristics of Leaded Steel and Free-Cutting Brass," which is available from the company's Dept. U21, Bellefonte, Pa.

The information should fill an undesirable gap in metalworking knowledge. Lack of data on the machinability of brass has been a handicap to some extent in the industrial world—although generally considered among the most easily machined metals, manufacturers could not afford to gamble on its use without an authoritative understanding of its characteristics under use and wear.

* * *

MOLYBDENUM has been successfully prepared by electrolytic methods as a result of research activities of Drs. Seymour Senderoff and Abner Brenner of the National Bureau of Standards working in a program sponsored by the Army Ordnance Corps.

High-purity molybdenum was produced by electrolysis of a bath fused salts—a process which is flexible and easily controlled and, depending on the conditions of electrolysis, will provide deposits varying from fine powders to thick, coherent layers.

Circumstances which led to inauguration of the program was the growing need for heat resistant refractory metals.

High Purity Metal By Electrolysis

These of course turned attention to such materials as molybdenum and tungsten. However, the present process for producing molybdenum chemically as a fine powder is by reducing purified molybdic oxide with hydrogen. This is

not only expensive but has attendant disadvantages—although obtained as a very fine powder, size of the particles cannot be controlled; because of the powder's fineness, a large surface area is exposed to oxidation, necessitating extensive purification. Further, powder metallurgy procedures are required to fabricate the powder into molybdenum objects.

All these disadvantages may be avoided with the introduction of the electrolytic method, for deposits are obtained directly on the cathode in the physical form desired and in a pure

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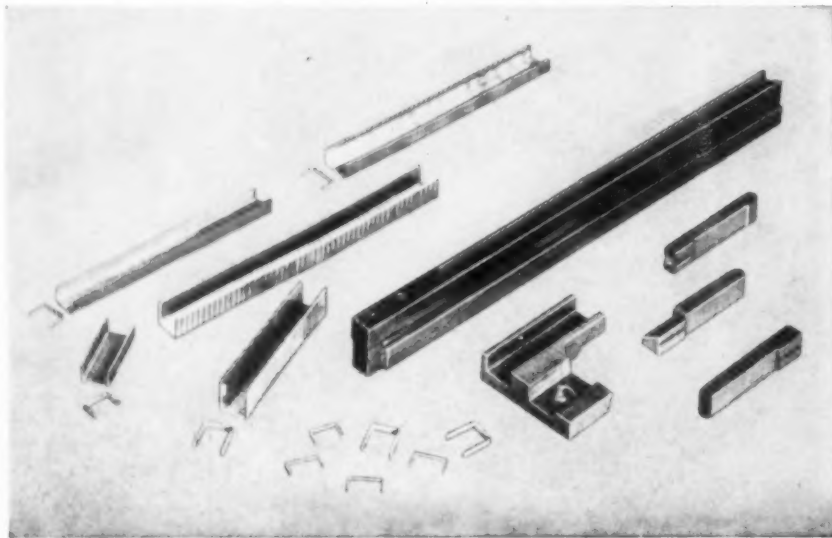
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state. Obviously the next step is application of the metal by methods of electro-winning, electrorefining, electroforming or electroplating, all of which are now under study. Electroforming would make possible formation of molybdenum parts having complicated shapes while electroplating would conserve the critical metal as well as permit the designer to take advantage of the properties of the basic metal. These eventualities would mean faster, less expensive methods for producing molybdenum parts and coatings and also for the extracting of the metal from its ore.

Similarly, other experiments, carried on at Columbia University have achieved separation of titanium from its ore electrolytically. If the process proves commercially feasible, it is believed that the price of that metal may well be brought into the cost range which is more competitive with presently used materials in those applications where titanium's properties indicate its justifiable use.

HARD FACING ALLOYS have been developed which are applied to steel and cast iron parts to provide high hardness and high resistance to abrasion, corrosion, oxidation and impact. These materials, known as Crobamate alloys, retain these properties at red heat and can be heated to as high as 1600 F with no permanent loss of hardness. Still they are not affected by repeated heating and cooling.

Alloys for Heat Wear Resistance

Application by either manual or semi-automatic machine with oxy-acetylene torch or inert arc welding, uses standard hard facing procedures. Through this process, they flow on readily in a uniform, slag-free layer and bond firmly with minimum inter-alloying. Applied, they provide a dense, hard layer of complex wear-resistant carbides evenly distributed in a cobalt matrix.

CONTROL SYSTEMS for the ultrafast stopping of electric motor-driven equipment have been developed by Techniflex Corp. In these systems, the braking

Braking for Motor-driven Equipment

action derives from the motor itself, directed by the motor control apparatus, known as the "Zero Plugging Control System." The braking action develops by the same principles by which the motor produces its starting and running torques. As a result, zero-plugging is very suitable to high frequency use, offers dependability, uni-

form of action and response and provides freedom from maintenance and adjustment.

For production machines which are not at present equipped with a brake, addition of the control system increases safety protection to both the machine and operating personnel, for it responds to emergency safety and overload switches. For economy, it proves its worth by eliminating time-wasting coasting between processing steps.

In cases of machinery already equipped with an electromechanical brake, zero-plugging may be used to replace or augment it—replacement, if the machine does not require a holding action after the machine is stopped; as an addition if holding is required, in which case zero-plugging takes the dynamic braking load, and the electromechanical brake then assumes the holding load. This latter combination considerably extends the life of the electromechanical brake and reduces maintenance costs.

★ ★ ★

ELEMENTS AFFECTING quality in surface grinding, such as operating methods and design factors, are presented in a comprehensive film on the subject,

Film Explains Surface Grinding

"Techniques of Surface Grinding." Following a methodical approach to the

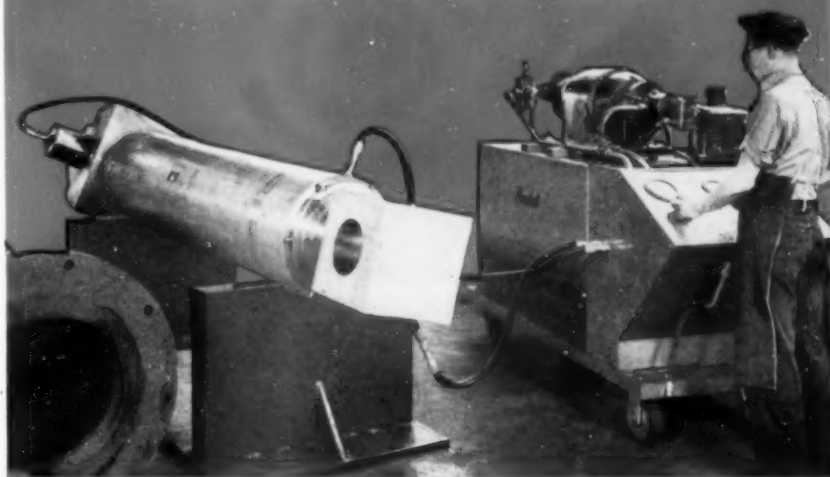
work, the film defines, and elaborates with demonstrations of performance, desirable characteristics of a surface grinder, including the ability to grind to calibrations, to achieve fine finishes and parallelisms, or to take heavy cuts without bringing about the undesirable effects resulting from overheating.

Features of construction, lubrication and mechanical design are examined from an "inside the grinder" treatment. A study of the assembly line to see manufacturing practice that assures quality work, follows a diagrammatic presentation of necessary quality requirements on which the machine is dependent to produce accuracy.

Several other pertinent points also are treated in the film. Proper methods for dressing and balancing grinding wheels are described and demonstrated; most efficient cooling of work is covered with the aid of photomicrographs of grinding particles; adaptation of the precision surface grinder to numerous tasks such as the grinding of shapes with a formed wheel is also discussed. Finally, the movie points up possibilities of automation in surface grinding.

The 31-minute 16mm sound film in technicolor, is available from The Do-All Co., Des Plaines, Ill., on a loan basis.

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Who's Meeting - and Where

June 6-11. SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Ambassador Hotel, Atlantic City, N.J. Get specific details from society office, 29 W. 39th St., New York 18, N.Y.

June 7-10. THE SOCIETY OF THE PLASTICS INDUSTRY, INC. Sixth national plastics exposition, Cleveland Auditorium, Cleveland, Ohio. Write to society office, 67 W. 44th St., New York 17, N.Y. for details.

June 7-18. ILLINOIS INSTITUTE OF TECHNOLOGY. Refresher course in "Basic Oil Hydraulics" designed for maintenance technicians and others in hydraulics field, IIT campus, Chicago. Contact school's Dept. of Mechanics, 3300 S. Federal St., Chicago 16, Ill. for further information.

June 9-11. AMERICAN SOCIETY FOR QUALITY CONTROL. Eighth annual national convention, Kiel Auditorium, St. Louis. Address inquiries to society office, 70 E. 45th St., New York 17, N.Y.

June 13-18. AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, Sherman and Morrison Hotels, Chicago, Ill. Contact society headquarters, 1916 Race St., Philadelphia, Pa. for details.

June 14-18. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Second U.S. Congress of Theoretical and Applied Mechanics, University of Michigan, Ann Arbor, Mich. Get details from society, 29 W. 39th St., New York, N.Y.

June 14-18. AMERICAN SOCIETY FOR ENGINEERING EDUCATION. 62nd annual meeting, University of Illinois, Urbana, Ill. Get complete information from Lisle Rose, ASEE Public Relations Comm., University of Illinois.

June 14-15. MALLEABLE FOUNDERS' SOCIETY. Annual meeting, Seignior Club, Montibello, Quebec. More details are available from society office, 1800 Union Commerce Bldg., Cleveland, O.

June 14-19. AMERICAN SOCIETY OF CIVIL ENGINEERS. Spring meeting, Chal-

font Maddon Hall, Atlantic City, N. J. Send inquiries to society headquarters, 33 W. 39th St., New York, N.Y.

June 14-26. STATE UNIVERSITY OF IOWA. Fifteenth Management Course, under direction of the school's College of Engineering, covering production planning, job evaluation, motion and time study, plant layout, quality control, etc. Write Mr. J. Wayne Deegan, 118 Engineering Bldg., State University of Iowa, Iowa City, Iowa, for data.

June 15-25. MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Special two-week summer program on "Machine Tool Technology" for users and builders of machine tools; will cover fundamentals of design, use and evaluation of machine tools as well as elements of fine measurement, statistics and quality control principles. For details contact Prof. Prescott A. Smith, Dept. of Mech. Engrg., MIT, Cambridge, Mass.

June 16-18. COMMITTEE ON VACUUM TECHNIQUES. High vacuum symposium, Berkeley Carteret Hotel, Asbury Park, N. J. Will cover nomenclature and standards; equipment; fundamental developments; methods and techniques; applications and processes. Direct inquiries to P.O. Box 1282, Boston, Mass.

June 20-24. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting, William Penn Hotel, Pittsburgh, Pa. Society office, 29 W. 39th St. can give details.

June 20-25. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. National meeting, University of Michigan, Ann Arbor, Mich. Get more facts from Institute office, 120 E. 41st St., New York 17, N.Y.

June 21-25. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Summer and Pacific general meeting, Biltmore Hotel, Los Angeles, Calif. Write to Institute headquarters, 33 W. 39th St., New York 18, N. Y., for more details.

June 27-29. ALLOY CASTING INSTITUTE. Annual meeting, The Homestead, Hot Springs, Va. Contact the Institute office, 32 Third Ave., Mineola, N. Y. for all facts.

July 12-15. AMERICAN ELECTROPLATERS' SOCIETY. Annual meeting, Statler Hotel, New York, N. Y. Complete data is available from society headquarters, 445 Broad St., Newark 2, N. J.

July 13-15. WESTERN PLANT MAINTENANCE SHOW. To be held concurrently with Plant Maintenance Conference, Pan Pacific Auditorium, Los Angeles, Calif. Direct inquiries to Clapp

and Poliak, Inc., 759 Monadnock Bldg., San Francisco 5, Calif.

Aug. 3-4. PACKAGING MACHINERY MANUFACTURERS INSTITUTE. Semi-annual meeting, Dennis Hotel, Atlantic City, N. J. Write for more information to Institute office, 342 Madison Ave., New York 17, N. Y.

Aug. 16-18. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. West Coast meeting, Statler Hotel, Los Angeles, Calif. Write to society office, 29 W. 39th St., New York 18, N. Y. for details.

Sept. 1-16. INTERNATIONAL ELECTRO-TECHNICAL COMMISSION. Golden Jubilee Meeting, University of Pennsylvania, Philadelphia. Direct correspondence to U. S. National Committee, American Standards Assn., 70 E. 45th St., New York 17, N. Y.

Sept. 14-23. FOURTH EUROPEAN MACHINE TOOL EXHIBITION, Milan, Italy. For all details concerning the show, write to Dr. Ing. Enrico Brivio, general commissioner, Unione Contruttori Italiani Machine Utensili, Via Gaetano Giardino, 4, Milan, Italy.



Mr. Ervin Lonze (left), President, and Mr. Kenneth Rolin (right), Chief Tool Engineer of Era Tool and Mfg. Co., of Franklin Park, Illinois, experts in precision parts production, say

"We built another die, using Pivot Straightground Punches, to produce tuner chassis. Short runs over a period of 18 months have totaled 125,000 parts and the die has not been in the die repair department once.

"It is easy to understand why we have standardized on Pivot Straightground Punches and why we now are building better dies for less."



clocked at 5800%

PIVOT HIGH SPEED STEEL PUNCHES
STRAIGHTGROUND • WHIPSLEEVED

**INCREASE PRODUCTION AT
ERA TOOL AND MFG. CO.
MORE THAN 65 TIMES!**

Three of the eleven holes to be performed in .042, 3/4-hard, clock brass were to be .019, .023 and .027 — holding .0004 tolerance with 125 micro finish or better. That's a tough job — and production with the original die and ordinary punches, using the quill or point guide principle, was 15 to 600 pieces per set-up.

Then the die was equipped with Pivot Straightground Whipsleeved Punches. Production immediately averaged 40,000 — with no rejects — without breaking a single punch!

You, too, can gain the advantages of greater concentricity, accuracy, power and longer punch life, at minimum maintenance cost. Put Pivot Punches to work for you NOW.

**SEND FOR FREE CATALOG AND
STANDARD PRICES. WRITE DEPT. T. E.**

pivot punch and die corp.

NORTH TONAWANDA, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-167



Men at Work . . .

Two engineering appointments at the new operating Chemical Specialties Div. of Pennsylvania Salt Mfg. Co. involved **E. S. Garverich** and **Richard O. White**. Mr. Garverich, will now serve as technical director in charge of technical service and product development. Mr. White, who has been superintendent of Pennsalt's Montgomery, Ala., plant, is now production manager and will direct manufacturing activities of the division.

Promotions recently announced by Standard Pressed Steel Co. have moved **Edwin Y. Bready**, **Charles A. Thomas, Jr.** and **James L. MacDowell** to the ranks of top management. Mr. Bready, formerly director of purchases, is now division manager of the Hallowell Pressed Steel Div. Mr. Thomas, manager of industrial relations and industrial engineering, has also been given charge of production control, quality control, estimating and cost analysis.

Mr. MacDowell advances from manager of tooling and quality to the post of superintendent of manufacturing, Fashener Div.

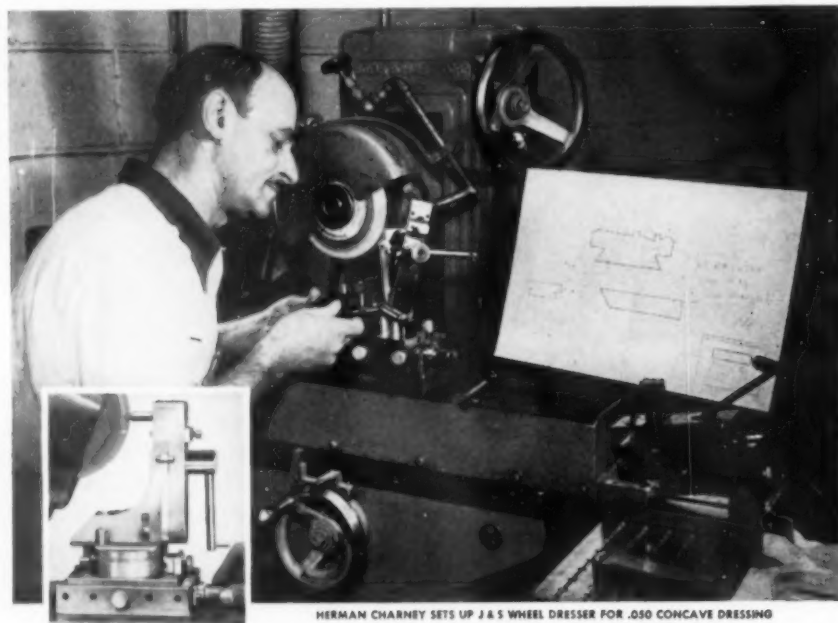
Following the recent death of its president and board chairman, **Knowlton D. Montgomery**, shareholders of Hunter Spring Co., met to elect a new directorate and slate of officers. The directors are **W. J. Cook**, **P. C. Clarke**, **C. Randle Grimes**, **W. R. Spofford**, and **H. O. Hess**. This board then elected Mr. Cook, former vice-president and general manager, to the office of president; Mr. Clarke, previously secretary and assistant general manager, to executive vice-president; **S. K. Freed**, treasurer; Mr. Hess, secretary, and **F. E. Cassel** as assistant secretary.

George Backman has been named manager and chief engineer of the Rolling Mill and Mill Machinery Div. of Waterbury Farrel Foundry & Machine Co., succeeding **Irving H. Tolles** who retired. Mr. Backman, who has been associated with the company since 1930, has been an assistant to Mr. Tolles.

At the same time, **Harry Lange** was promoted from assistant chief engineer to chief engineer in charge of Bolt, Nut, Screw and Rivet Machinery Div., a position formerly held by **Joseph M. Schaeffer** who recently was made president of the company.

Three new appointments to the production control department of its general machinery division have been made public by the Allis-Chalmers Mfg. Co. **H. E. McConahay**, who has been superintendent of production scheduling, is now superintendent of the material control section. **L. E. Worley**, now superintendent of the scheduling section was formerly assistant section superintendent and now is succeeded in that position by **J. E. Brinkmann** who formerly was foreman.

At the recent election of officers at M.B.I. Export & Import, Ltd., **J. J. Neureither**, chief engineer of the company, was re-elected vice-president. **D. Gladstone** was promoted to the position of comptroller, while **F. Hollander** was elevated to the office of secretary.



HERMAN CHARNEY SETS UP J & S WHEEL DRESSER FOR .050 CONCAVE DRESSING

Saves hours by setting angles in seconds, radii in minutes

A typical job made easier with a J & S "Fluidmotion" Wheel Dresser

Here's a wheel dressing job which calls for 13 angles, 4 radii, 7 flats. Ordinarily you might expect to spend from 5 to 30 minutes for each setting. With a J & S "Fluidmotion" Wheel Dresser, tool grinder Herman Charney made all 24 settings in just 21 minutes.

Time-saving Features

An unusual case? No — it's typical of the speed and ease of operating a J & S Wheel Dresser. Setting 2 angles with a "Fluidmotion" Dresser, for example, takes only 10 seconds. Setting a radius takes only 2-3 minutes.

Note just how easy it is to operate a J & S Wheel Dresser. All you need is a micrometer and a simple hex wrench. You can forget about gage blocks, height gages and master gage settings. No need to bother either with parallel bars, surface plates or dial indicators.

With the "Fluidmotion" Dresser, you can also dress two angles tangent to a radius in one continuous motion. After dressing the angles, the diamond automatically returns to center.

Accurate to 0.0001"

Accuracy? You can make concave and convex contours at a full 180 degrees with a guaranteed accuracy of 0.0001". J & S dressed forms, too, are always clean and precise. Angles and radii flow into each other, free of tool or chatter marks.

These are some of the benefits you get when you use a J & S "Fluidmotion" Wheel Dresser. A variety of models are available for dressing wheels up to 24" in diameter. Construction in all cases is of high-carbon, high-chrome steels.

Write for complete information today



WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • SINE BARS • DOWN-HOLDING DEVICES

543 W. MT. PLEASANT AVENUE, LIVINGSTON, NEW JERSEY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-168



Hugh T. Price, Jr. has been named factory manager of Norton Co.'s Grinding Machine Div. He was previously production manager, a position now assumed by Roland T. Nelson.



Paul K. Rogers, Jr., formerly vice-president of Skinner Chuck Co. and Skinner Valve Div., has been elected president to succeed Arthur E. Thornton who became chairman of the board.



William F. Wilson was appointed works manager of The Gear Grinding Machine Co. He joins the firm after four and a half years with Walker-Turner Div. of Kearney & Trecker Corp.



Sidney Andrews is the new vice-president in charge of research and development for Metal Removal Co. He formerly had been associated with Bay State Abrasive Products Co.

J. W. McMullen, general manager of Pittsburgh Works of Allis-Chalmers Mfg. Co. has been named vice-president in charge of transformer and switchgear equipment. In this capacity, Mr. McMullen will be responsible for operation of both the Pittsburgh and Boston Works, and for all transformer and switchgear operations at Hawley, West Allis and Terre Haute plants.

Election of Arthur M. Grasse as vice-president in charge of industrial products has been revealed by the Goodman Mfg. Co. Mr. Grasse, who has been connected with Goodman for the past 33 years, will also continue in his previous position as manager of the Industrial Manufacturing Div.

Appointment of M. W. Zolton to the post of general manager in charge of manufacturing and engineering facilities has been announced by York-Gillespie Mfg. Co. Mr. Zolton joins the firm after 18 years' experience in production and management in heavy industry. He leaves a post with Barium Steel Co. where he has been manager of its special products division.

New appointments at Allied Products Corp. include the elevation of W. Curtis Miller and Leland E. Coulter to vice-presidencies and V. Leonard Hanna to the newly created office of controller. Mr. Miller has been general manager of the company's plant No. 4 of Hillsdale, Mich., now will assume management of Plant No. 3, though available in a consulting capacity at the former plant where John Gergel now succeeds him as general manager. Mr. Coulter, who has been with Allied since 1936, will have complete charge of the RB and Hercules interchangeable punch and die activities, with headquarters at a new plant now under construction near Detroit. Mr. Hanna joined Allied a year ago from International Textbook Co.

NEW! ROTOR AIR GRINDERS

**LIGHTER!
MORE POWER!**

Rotor "D-6"... the new, lightweight (9 1/4 lbs.) tool for heavy-duty work

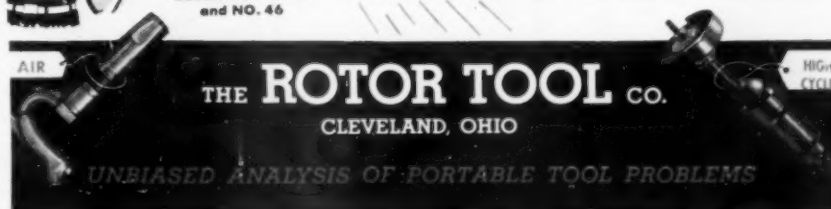
Rotor "D-8"... all the power you can use and weighs only 12 1/4 lbs.



ASK FOR BULLETINS NO. 45 and NO. 46

SPECIFICATIONS				
	RPM	WEIGHT*	LENGTH†	WHEEL SIZE
D-6	6000	9 1/4 lbs.	22 1/4"	6" elastic
	4500			8" elastic
	4100			8" elastic
D-8	6000	12 1/4 lbs.	21 1/4"	6" elastic
	4500			8" elastic
	4100			8" elastic

*For straight handle. For grip handle add 3/4 lbs.
†Deduct 1 1/2" for grip handle.



FOR FURTHER INFORMATION, USE READER SERVICE GUIDE; INDICATE A-6-169

TRADE LITERATURE

For Free Booklets and Catalogs—
Convenient Request Card on Page 139

Taps

Illustrated 20-page catalog No. 10 provides data on size, threads, flutes and prices for standard and special taps; also describes company's production methods and quality control procedures. Reiff & Nestor Co., Lykens, Pa. L-6-1

Grinding Fluids

Two 16-page brochures deal with grinding fluids. "Precision Grinding Oils" discusses characteristics and functions of seven products covering proper applications and giving specific recommendations for their use. The second

booklet, "Water-Mix Cutting and Grinding Fluids" outlines proper selection and applications of four different fluids; discusses various types of water mixtures and factors in proper selection and application. D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

L-6-2

Meehanite Castings

Twelve-page booklet devoted to application problems solved by Meehanite cams, camshafts and crankshafts; also describes basic metallurgy and chief important engineering properties of types of Meehanite metal most widely used for such service. Illustrated. Meehanite Metal Corp., 714 North Ave., New Rochelle, N. Y.

T-6-3

Limit Switches

Illustrated literature gives detailed information on heavy duty machine tool limit switches; describes important points of construction, operation and uses. Square D Co., Industrial Controller Div., 2021 N. Richards St., Milwaukee 12, Wis.

T-6-4

Broaching

Illustrated pamphlet covers details of the Rausch-vertical Broaching machine for production specially designed for small job shops; lists technical data, outlines exclusive features, discusses operation, production and performance. Manufacturers Associates, 92 Liberty St., New York, N. Y.

L-6-5

Cylinders, Valves

Complete line of oil hydraulic cylinders and hydraulic directional control valves presented in Bulletin 22; includes dimensional drawings and tables for each type model; outlines construction points; charts offer help for estimating hydraulic functions. Pathon Manufacturing Co., Pacific Ave., Cincinnati 12, Ohio.

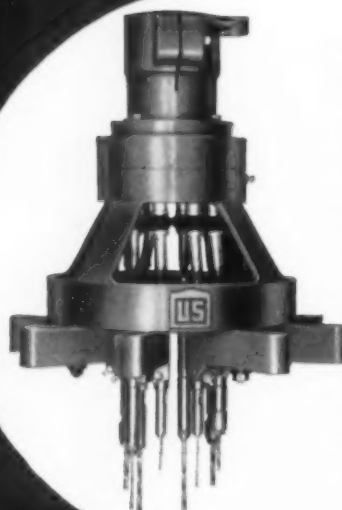
L-6-6

Positioners

General Catalog No. 110 offered as a complete review of company's vises, clamping and positioning tools. Contains cross-sectional drawings showing internal construction of products, and cross-reference charts of competitive lines. Indexed for easy reference. Wilton Tool Mfg. Co., Dept. CR, 941 Wrightwood Ave., Chicago 14, Ill.

L-6-7

KEEPING UP WITH THE JONESES



U-1



U-2

The "Joneses" and the companies they own save money, time and effort by relying on "US" Adjustable Multiple Spindle Drill Heads with QUICK-CHANGE universal joint assemblies.

We give the "Joneses" and you—immediate delivery.

The U-1 Head—two to eight spindles—can be adjusted to a minimum distance between spindles of 11/16" anywhere in an area of a 6" diameter circle.

The U-2 Head has two to twelve spindles, each built to drill up to 3/4" diameter hole in cast iron. Standard spindles are furnished with No. 1 or 2 Morse Taper.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear driven adjustable, fixed center, or individual lead screw tapping heads.



UNITED STATES DRILL HEAD CO.
616-618 Burns St., Cincinnati 4, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-170

Power Transmission

Twenty-four page illustrated catalog presents company's transmission equipment including variable speed pulleys, wide belts, sheaves, motor bases, countershafts and Select-O-Speed transmissions. Contains dimensional drawings, lists ratings and dimensions, tables outline representative applications. Lovejoy Flexible Coupling Co., 4998 W. Lake St., Chicago 44, Ill. **L-6-8**

Turret Lathe

Photos, drawings and tables illustrate Bulletin No. 123 explaining construction, operation, special features and advantages of P&J 5-D2 Power-Flex automatic turret lathe. Potter & Johnston Co., Newport Ave., Pawtucket, R.I. **L-6-9**

Stamping Presses

"New Life for Worn-Out or Damaged Presses," Bulletin No. R-49, outlines company's rebuilding facilities as they might concern firms interested in modernization of stamping presses through rebuilding; shows examples of typical jobs. Verson Allsteel Press Co., 9336 S. Kenwood Ave., Chicago 19, Ill. **L-6-10**

Chucking

Fully illustrated 32-page Catalog No. 105 covers power chucking equipment including its new compensating power chuck; contains engineering drawings, dimension tables and descriptions. Also presents similar data on rotating air cylinders, duplex cylinders, air valves and accessories and blank jaws. The S.P. Mfg. Corp., 12415 Euclid Ave., Cleveland 6, Ohio. **T-6-11**

Motor Frame Standards

"Compar-A-Frame" chart, offered as aid to engineers and designers, compares old and new NEMA a-c frame assignment standards, to avoid confusion over old and new mounting dimensions. Covers open type and fan-cooled type polyphase induction motors; subcharts compare frame sizes according to horsepower and speed. Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio. **L-6-12**

Bushings

Revised bulletin pictures and describes bushings for sheet metal and laminate plastic drill templates explaining their economy and other advantages, how to make sheet metal and laminate plastic drill templates. Introduces Anchor Bushing number system and simplified method of ordering. The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif. **T-6-13**

HOW MANY OPERATIONS

WHEN YOU PREPARE

STEEL FOR PAINTING?

	Operations
Cleaning	1
Rinsing	1
Pickling	1
Rinsing	1
Conditioning	1
Rinsing	1
Drying	1
Total	3

What's wrong with that addition? How can seven operations add up to three operations?

It's easy when you use Oakite Compound No. 33 (or Oakite Compound No. 31) to remove rust or heat scale *at the same time that it removes oil at the same time that it prepares steel (or aluminum) for the lasting adhesion of paint.*

That combines cleaning, pickling and paint conditioning into one operation. After rinsing and drying, you have saved the time, the tanks, the space and the solutions for four operations.

O. C. No. 33 is great for removing heavy soil in tanks or for cleaning by hand. O. C. No. 31 is very economical for removing moderate soil in tanks. Each compound is able to strip certain types of paint.

FREE For booklets describing the specific advantages and applications of Oakite Compounds Nos. 31 and 33, just mail the coupon.

Technical Service Representatives in Principal Cities of U.S. and Canada

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MATERIALS • METHODS • SERVICE

OAKITE PRODUCTS, INC.
58 Rector St., New York 6, N. Y.

Send me your **FREE** booklets on Oakite Compounds Nos. 31 and 33. I am especially interested in removing the following soils from () steel, () cast iron, () sheet aluminum, () aluminum castings:

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| <input type="checkbox"/> Oil and grease | <input type="checkbox"/> Carbon smut | <input type="checkbox"/> Tarash |
| <input type="checkbox"/> Drawing compounds | <input type="checkbox"/> Paint | <input type="checkbox"/> Welding flux |
| <input type="checkbox"/> Rust preventives | <input type="checkbox"/> Rust | <input type="checkbox"/> Soldering flux |
| <input type="checkbox"/> Identification inks | <input type="checkbox"/> Heat scale | <input type="checkbox"/> _____ |

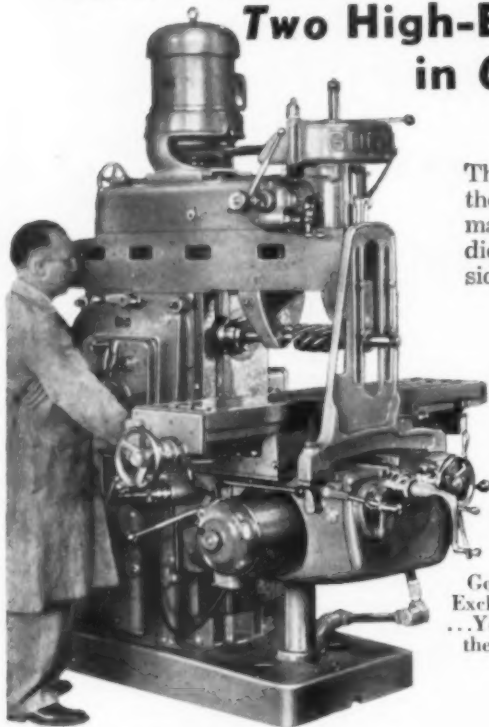
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COMPANY _____

ADDRESS _____

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New Gorton 2-28 Brings You Two High-Efficiency Mills in One Money-Saving Unit



... as a horizontal mill.

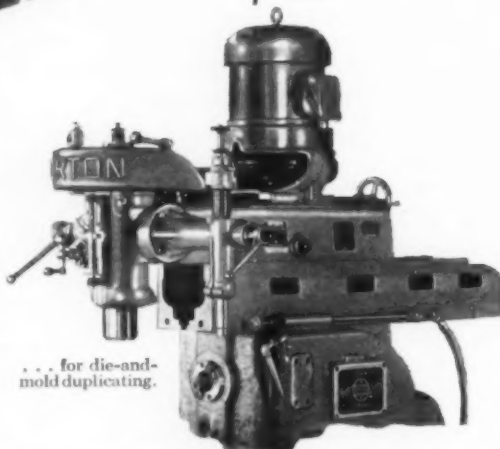
The Gorton Receptor Ram makes the new 2-28 a true multi-purpose machine... "tailor-made" for all die-mold-machine shops. Consider the facts:

**HORIZONTAL MILL
VERTICAL MILL
(Super-speed)**

DUPLICATOR (Simply add a duplicator head and a duplicator table.)

NOTE: You can switch from horizontal to vertical high-speed milling in 5 minutes or less. Save space and capital equipment — and increase production facilities at the same time.

Gorton
Exclusives
... Yours in
the 2-28



... for die-and-mold duplicating.

- Fullwidth knee, 24½ inches wide, provides extreme rigidity. Even under heavy cutting loads, there's no sag or twist.

- New lubrication system dissipates heat to prevent spindle "growth"... to promote full use of spindle horsepower... to end the necessity for adjusting cutter depth to compensate for differences between "hot" and "cold" operation.

- High-speed head delivers spindle speeds up to 4000 rpm. Horizontal spindle: up to 2000 rpm — 7½, 10 or 10/5 hp at spindle nose.

- Double-extension feature of the Receptor Ram greatly increases work area, vertical capacity and transverse cutting capacity on either the Gorton 2-28 or 3-34 Horizontals.

- Down time and maintenance are drastically reduced by true unit construction features. A removable coolant pan speeds sump cleaning and coolant changing.

- Overload protection automatically safeguards expensive cutters. A horsepower-load meter constantly indicates cutter condition and operating efficiency.

- Full directional front and rear controls are interlocked.

You can't afford to overlook this Gorton Horizontal with Receptor Ram. It could produce more profit per dollar invested than any other machine you have. Fill out and mail the coupon.

**GEORGE
GORTON
MACHINE CO.**

2606 Racine St., Racine, Wis., U.S.A.



Please send at once Bulletin 1655-2606 and data on Gorton Horizontals.

Firm

Name

Title

Address

City, State

A 7788-7/5

Spindle Bearings

New Departure machine tool spindle bearing manual outlines fundamental principles involved in maintenance of machine tool spindles for high precision work. Gives step-by-step analysis of both dismounting and assembly of 10 typical ball bearing supported spindles, illustrated by cut-away drawings; explains necessity for standards and close tolerances in modern machine tools. Distributed for New Departure Div. by United Motors Service, Div. of General Motors Corp., Detroit 2, Mich. L-6-14

Cylinders

Specifications and engineering data on air and both high and low pressure hydraulic cylinders presented in 32-page loose-leaf catalog; illustrated with dimensional drawings. Petch Mfg. Co., South Shore Rd., Alpena, Mich.

T-6-15

Impact Extrusion

Sixteen-page brochure, "Alcoa Impact Fact Book," covers various facts necessary to design products as impact extrusions; includes information on such phases of the subject as what is an impact and how does it work, basic tools and pieces produced, discussion of forward and solid impacts, design facts, tolerances, alloy selection, secondary operations, and finishes. Request directly from Aluminum Co. of America, 724 Alcoa Bldg., Pittsburgh 19, Pa.

Threading Machines

Informative brochure presents the 32C and 48C Landmaco threading machines designed for heavy duty threading of large diameter workpieces; gives detailed account of construction, operation, advantages and performance features. Landis Machine Co., Waynesboro, Pa.

T-6-16

Surface Grinders

Catalog B-53 presents company's Type B hydraulic surface grinders in sizes ranging from 6 x 18 in. to 12 x 120 in., giving complete features and specifications and locating all main controls; includes clearance drawing and wheel sizes for each machine. The Thompson Grinder Co., Springfield, Ohio. T-6-17

Milling Machines

Illustrated literature describes various sizes in the line of Cervinia milling machines, both Universal and plain, and vertical; outline points in construction, advantages of the units, working features and lists specifications of each unit. Bulletins available from distributor, Misal Machinery Inc., 1 E. 53rd St., New York 22, N. Y. L-6-18

good reading

CLOSED DIE FORGING PROCESS by E. P. Kyle. Published by The MacMillan Co., 60 Fifth Ave., New York 11, N. Y. Price \$1.50. 140 pp.

The purposes of this book are to describe briefly the essential steps in producing drop forgings and to discuss some of the uses to which closed die forgings can be adapted. The properties of forge metals are dealt with to some extent and the fundamentals of hot working are explained.

SCIENTIFIC RESEARCH AND DEVELOPMENT IN AMERICAN INDUSTRY, BULLETIN NO. 1148. Published by the Bureau of Labor Statistics, Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 50-cents. 106 pp.

This bulletin is a comprehensive report on American industrial research resources resulting from a survey by the Research and Development Board in 1952.

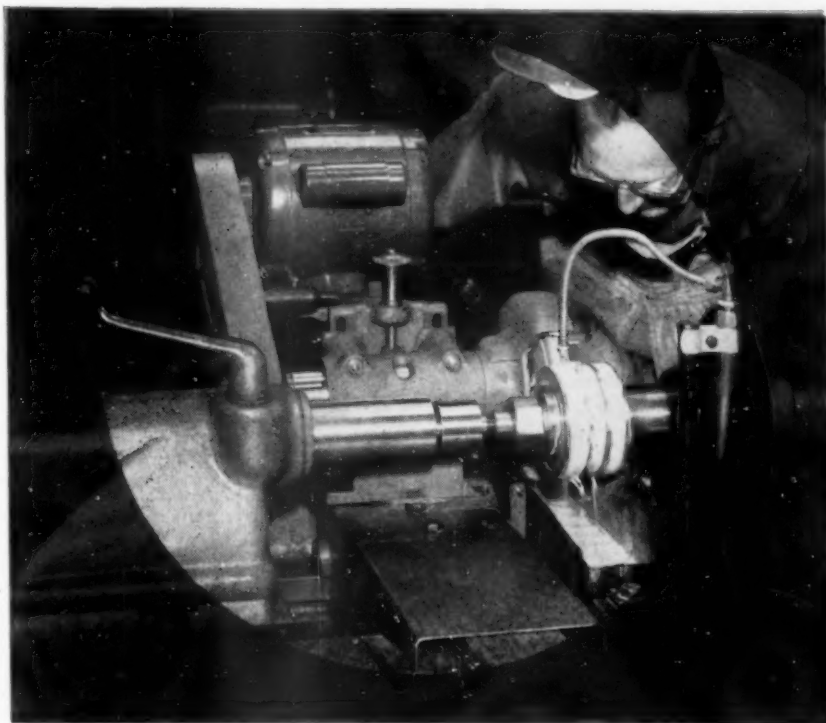
Among the topics discussed are Turn-over Rate of Professional Research Staffs; Research Engineers and Scientists as a Percent of Total Company Employment; Research Costs as a Percent of Sales; and Extent of Increase in Government-Financed and Company-Sponsored Research for 1951. In all sections of the report, separate figures are given for major manufacturing and nonmanufacturing industries and for companies of different sizes.

STRESS CONCENTRATION DESIGN FACTORS by R. E. Peterson. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price \$8.50. 155 pp.

The purpose of this book is to enable designers to improve design calculations to the end that failure will be less prevalent and better-balanced designs will be achieved. The book should be regarded as a working tool; it is not intended to be a textbook in the usual sense.

Enough background and references are given to enable further exploration of the subject. This tab indexed book is illustrated with charts and drawings.

Here's fast, inexpensive grinding for die jobs



Virco Mfg. Co., Garden City, Calif., uses this lathe-mounted No. 12 Dumore Grinder on a plunge grind, to recondition tube forming roller dies.

Plunge grind with a Dumore saves time . . . money and trouble on die-reconditioning job

THIS school equipment manufacturer used to send tube forming roller dies "out" for reconditioning. Today, the job's being done in his shop . . . in a matter of 1½ to 2 hours . . . at a fraction of the \$30 to \$40 it used to cost.

These savings in time, money and trouble are possible because reconditioning is done with a versatile, lathe-mounted Dumore Tool Post Grinder. This precision tool swings an 8" x

1¼" x ¾" wheel on a direct plunge to grind the required ½" radius.

This versatility is another reason why Dumore Grinders are a favorite with production, maintenance and tool room men everywhere. It's also an example of one of the hundreds of uses of Dumore Tool Post Grinders that may help you. Make sure you have all the up-to-date information. Get in touch with your Industrial Distributor soon, or write —



Builders of a precision line of Tool Post Grinders, Hand Grinders, Drill Grinders, Automatic Drill Heads, Light Drilling Equipment, Flexible Shaft Tools, Quills, F/hp Electric Motors and Gear-motors.

DUMORE PRECISION TOOLS

The Dumore Company

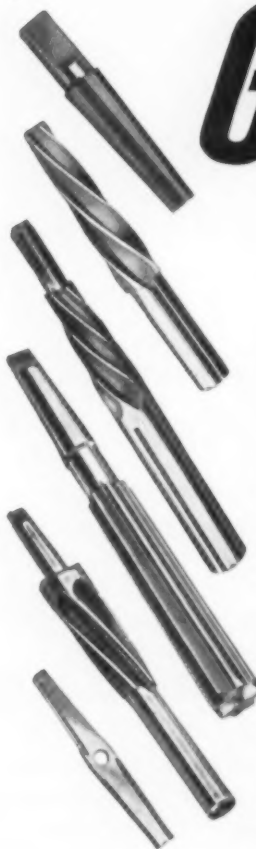
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FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and

manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

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MATERIALS AND PROCESSES

by James F. Young. Published by John Wiley & Sons Co., Inc., 440 4th Ave., New York 16, N. Y. Price \$8.50. 1074 pp.

Presented in one volume is inter-related information needed to apply engineering fundamentals of materials and processes to the design, production and control of products. The engineering viewpoint is applied to the fields of metallic and nonmetallic materials and manufacturing processes.

Coverage of developments of the last ten years incorporate recent advances in physical metallurgy and chemistry, materials property data and process tolerances, latest industrial practices and an inclusive summary of topical literature.

HANDBOOK OF STANDARD TIME DATA by Arthur A. Haddon and Victor K. Genger. Published by The Wiley Press Co., 15 E. 26th, New York 10, N. Y. Price \$10.00.

This book makes available detailed standard time-study data for establishing machine shop time values. Numerous, easy-to-use tables can, in addition to other advantages, be used in bid and quotation work, to prepare estimates, to calculate subcontract work time.

The book defines time-study terms and discusses by chapter the machinability of metals, handling elements and allowances, and relates the various machinery operations with time-study methods.

HANDY-QUIK TOLERANCES by Alexander Michael, Sr. Published by Handy Length Book Co., 3507 17th St., Canton, Ohio. Price \$1.00. 94 pp.

This pocket-sized booklet was prepared to give men in industry a convenient reference for tolerances and a method for learning industrial fractions and decimal equivalents.

MILLING CUTTERS—DESIGN, APPLICATION AND MAINTENANCE. Published by Milling Cutter Division of the Metal-Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price \$1.00. 40 pp.

This pamphlet is intended to serve as a guide to industry in properly applying the many available tool materials with respect to correct design, use and care of milling machine cutters.

Discussed in outline form are: overall economies, design, application and sharpening and care. Photographs, drawings and tables are combined with complete nomenclatures and definitions of cutters.

New Production Methods and Machines

technical

By Walter P. Hill

President
Walter P. Hill, Inc.
Detroit, Mich.

THE KEY TO GREATER OUTPUT per worker lies in the hands of production engineers and machine designers. It is they who put into effect the new process, the product redesigns and the production equipment that assure greater output per piece and thus solidify and improve our nation's economy.

The reason metalworking machinery has been able to stay in a relatively undeveloped state is because of the tremendous emphasis placed on assembly line techniques and materials handling.

Every machine tool had a man in front of it to load and unload every part. At the end of the conveyor carrying prodigious amounts of parts was an inspector carefully gaging every part.

Output Increased

Carbide tools have speeded up cutting cycles. Quality control systems have enabled inspectors to inspect only a portion of the batch of parts. Some operators stand in front of processing machines that do several operations. Some strides in the development of new production methods have been made in the fields of metal extrusion, metal forming

and assembly. Actually, metallurgical improvements have probably done more to raise production rates in metalworking plants than any other single factor.

Metalworking company managements must recognize that their salvation depends on their ability to reduce product cost through increased output per worker. Those who do not buy this idea will ultimately lose their share of the market and fall by the wayside.

Job shop type operations supply the majority of heavy equipment for industry. If the output per man hour is raised in the low production field, industry will have to spend less money for much of its high expense equipment. The job shop type of industry can well afford to invest in equipment and processes designed to meet its specific needs.

Special Machines Needed

The design of production machines of the future must be aimed toward the pushbutton factory.

Production machines will not be standard machines. To produce parts at maximum efficiency a machine tool must be designed for its specific operation.

Fig. 1. The process in which the machine tool is used may have to be altered to attain maximum productivity. The part must be designed to fit the process.

The current attitude of the government which lets manufacturers write off special machine tools in a short period should be a great stimulus to manufacturers to further exploit their stake in the period of automation that most certainly lies ahead.

One factor that is a problem in the development of new production methods and machine tools is the time required to put a facility in operation once it is built. Completely automatic machines of radical new designs require longer try-out periods than standard types.

Often so-called Rube Goldberg designs go by the wayside because manufacturers are not patient until the desired output rate or precision is achieved.

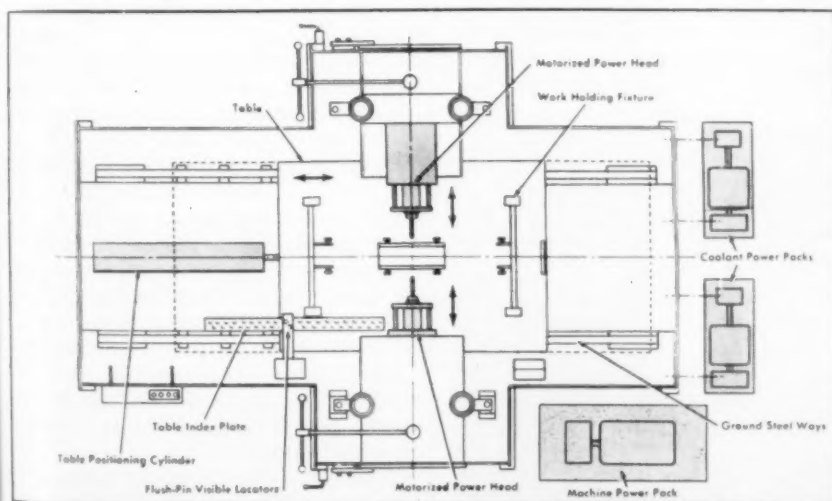
Tomorrow's machine tool, however, will be a completely integrated, extremely high-speed machine, automatically passing parts from operation to operation, gaging each part at each operation, changing tools when power requirements indicate the need. It will be more compact, more foolproof and require less maintenance than many dare to envision.

The operator will be more skilled in mechanics and less trained in therbligs. He will not even touch a part. Tomorrow's machine must turn out better parts faster to maintain and expand the economy and along with it the standard of living.

Air Conditioning Production Methods

The air conditioning industry has been called on to become a mass production industry. So the production methods have to be modernized and improved. New production processes have to be developed to suit individual needs. Now the industry is developing these processes and installing the new equipment needed to do the job.

Fig. 1. Opposed spindle drill for mechanizing job shop operations.



Another Production BOTTLENECK

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THE SOLUTION



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This AN Connector manufacturer was faced with the problem of accurately maintaining thread pitch diameter tolerances. Each thread size required taps of varying pitch diameter due to product and set-up variations. Tool costs and tool inventories were high. So, the Pratt & Whitney Cutting Tool Representative, a factory-trained specialist, was asked for recommendations. The use of Pratt & Whitney Expansion Taps for this application solved the problem . . . one tap for each thread size, expandable for proper control of product pitch diameter.

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* Not suitable for applications involving heavy chip loads per tooth.

technical digests

Previously, evaporator coils were completely assembled for the expansion operation. A line to a hydraulic pressure cylinder was connected to one end of the serpentine tube assembly and a plug was soldered in the other end. Then the tubes were filled with water and hydraulic pressure applied to expand the tubing against the fins to provide the necessary mechanical bond.

This method was unsatisfactory both cost and performance-wise. Complete assemblies were often scrapped because the thin tube section failed under the hydrostatic pressure. Dehydration processes were necessary to purge the tubing of water that would contaminate the refrigerant.

The new method, which cuts production costs and avoids scrap, makes use of a special tube expanding machine, Fig. 2. The fins are placed over the hair-pin tubes. Then this assembly is placed in the hydraulic powered expander where expansion mandrels enter the open ends, expand the tubes

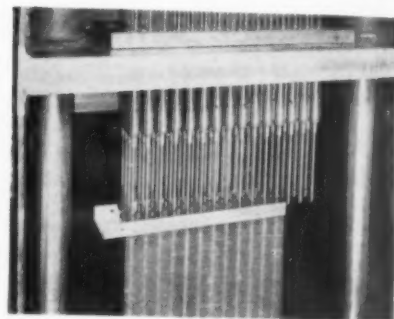


Fig. 2. Close-up of tube expander.

mechanically and also size the ends of the hairpin tubes for the return bends.

Following the expanding operation, return bends are soldered in position and the evaporator coil is ready for assembly in the air conditioning or refrigerating equipment. This method avoids plug brazing and dehydration operations and eliminates tube failures in weak tube sections.

Metal Forming and Extrusion

In developing special machines, to extrude from tubing shapes like plumbing tees and elbows, a rather unusual hydraulic press was developed, Fig. 3. It is well adapted to bending and extrusion operations on ferrous and nonferrous parts as well as upsetting drawing and coining operations that would require special auxiliary equipment on standard punch press equipment.

Stampings, for example, which require deep draws and additional opera-

The Tool Engineer

technical digests

tions can be simply produced on these presses. Multiple operations such as piecing or deforming can be simultaneously performed during deep drawing operations.

These hydraulic powered special machines were named inverted presses. They have their hydraulic cylinder in the base. This design reduces over-all height, avoids shut height limitations,

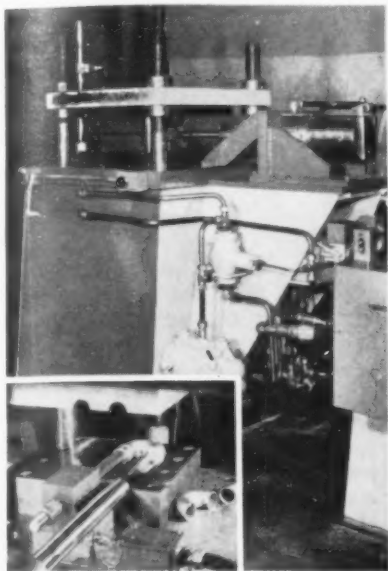


Fig. 3. Inverted press showing elbow forming operation (close-up).

lowers center of gravity and increases press flexibility by providing areas at the top and sides for the mounting of auxiliary hydraulic cylinders. When double acting or multiple operation dies are required, a special complete inverted hydraulic press that will do the job can be built with the die installed at a cost considerably less than a standard punch press.

In a typical operation on an inverted press, individual straight pieces of tubing are placed in the die, and dual push-button controls are actuated by the operator. The dies then close, the auxiliary cylinder or cylinders extrude the tube to the elbow form and the dies open, permitting the finished part to be removed manually.

Drilling Field Developments

To speed production in the job shop type of operations, particularly in the drilling field, special equipment is needed. Radial drills and bushing plates certainly have a place in the metal-working industry. But to resort solely to this method of making holes is to further delay product cost cutting.

Shown is a special drilling machine,

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June 1954

MACHINE TOOLS • CUTTING TOOLS • GAGES

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Fig. 1, designed and built for the manufacture of condenser tube sheets. This new drill has two power heads mounted opposite each other. These heads are hydraulically positioned vertically to various index positions. The work is fed between the heads. Two holes with center distances that obviate the use of conventional bushing plates are drilled in the tube sheet at each horizontal table setting.

This machine produces the drilled holes in 1/10 the time required by the former layout, spotting and radial drilling method.

From a paper given at the 1954 Machine Design Conference of the Cleveland Engineering Society



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Profiting from Patent Research

By George V. Woodling

Patent Attorney &
President, Flodur Co.
Cleveland, Ohio

In developing a new product for a new field, a company has three alternatives. As a first plan, the company may assign the task of designing the new product to its engineers and let them experiment with the new product in the hope that they might come up with a new design of improved features. Experience shows that this method—turning the engineers loose in a new field without a planned program of research—places them at a disadvantage.

As a second alternative, the company may hire a top-ranking engineer from another company already engaged in

the new field with the expectation that the new engineer with his wealth of technical knowledge can design the new product with the greatest of ease at a minimum of experimental costs. The difficulty with this plan is that the new engineer is apt to direct the lines of the new design along lines similar to the product made by his former company. In this event, little is gained since the new product would be devoid of additional patentable values which are so necessary when a company enters a new field.

As a third alternative, the company may obtain technical knowledge and know-how by making an exhaustive search in the Patent Office. Thus the engineers, even though new or fresh to the field, can develop a new product by avoiding pitfalls encountered by previous inventors as recorded in files of the Patent Office.

Often an engineer thinks he has a new idea, only to find that perhaps sixty years ago the same concept was presented to the Patent Office. It is remarkable how many devices are reborn generation after generation. Although an invention may appear to be new, there is always the possibility that the same idea has been thought of before. This is especially true where the invention resides in a crowded field.

Sometimes the idea is born before its time and remains in obscurity for many years before the world is ready to accept it. A good example is the protective sleeve shown in the fitting in Fig. 1. Although its general utility was known

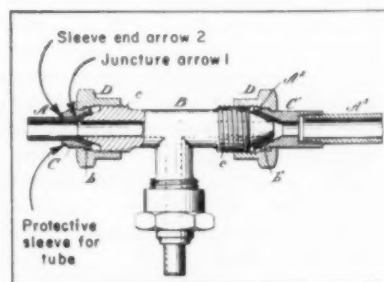


Fig. 1. Protective sleeve for tube fitting patented in 1883.

for many years, yet it was not until high pressure hydraulics came to the fore that such a sleeve found a particular utility in absorbing fluid shocks and vibrations.

According to the patents which were examined and studied, the sleeve of the type showed faulty from the standpoint

technical digests

of preventing tube breakage caused by fluid vibrations. The deficiency of this sleeve may be found in a statement taken from patent No. 2,391,266, which reads as follows:

"Tests have shown that despite the provision of these protective sleeves, objectionable tube breakages have occurred. When the sleeve loosely surrounds the tube, vibration has caused breakage at the base of the tube flares, or in other words, at the juncture (arrow 1, Fig. 1) of the tube proper and the flared end portion thereof. When it was attempted to remedy this condition by rendering the sleeves tight about the tubes throughout the length of the sleeves, vibration thus suddenly dampened at the sleeve end (arrow 2, Fig. 1) resulted in breakages at that point."

The patentee in patent No. 2,391,266 attempts to cure the problem of tube

gested. From this list of patents, it was learned that for a flare type of fitting, the protective sleeve should possess at least the following essential features:

1. At its forward end where it engages the flare it should not swell or ride upon the flare and jam within the nut, because such swelling or jamming would damage the flare when tightening the nut.
2. It should grip the tube resiliently at a place in front of the flare so that tube vibrations are not transmitted to the flare, which is the weakest point of the tube.
3. The sleeve should accommodate wide tolerances in tube diameters.
4. The sleeve should act as an internal locking device to prevent the nuts from becoming loose under mechanical vibrations.

From Patent Research to Development

These requirements simplified the goal of designing a fitting to prevent leakage. A great deal of time and expense were saved by beginning development where the prior patents left off. In this way, there was no overlapping or duplication between the new development and prior inventions. Patent research hastened the design of the tube fitting because inventive activity was directed toward features which would avoid pitfalls of prior inventors.

Patents as an "Idea-Generating Tool"

Besides functioning as a "know-how tool" for collecting prior art knowledge,

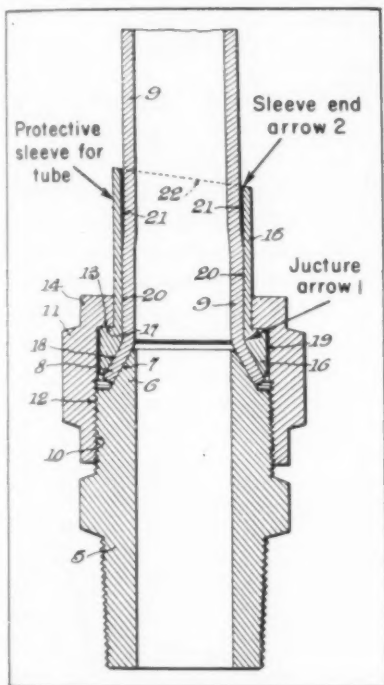


Fig. 2. Patent for this tube fitting points out defects of prior fittings.

breakage by constructing a sleeve as shown in Fig. 2. He points out that:

"... it is an object of the present invention to provide a novel tube and protective sleeve assembly in which the tube and sleeve are in permanent intimate wall-to-wall contact throughout a portion only of the length of the sleeve and including the tube-end flare base, thereby causing tube vibrations to be dampened gradually in the sleeve and well above the tube-end flare base."

The illustration cited above is but one of many found in the hundreds of patents which were checked and di-

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patents may be used as a tool to generate ideas which lead to new inventions. This comes about by respecting or honoring the claims of the prior patents of others rather than disrespecting them.

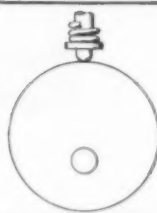
Prior patent claims set up fences which constitute barriers to prevent others or competitors from copying the invention which is thus patented or fenced in. The competitor may treat the patent claims in either one of two ways. First, he may disregard the patent and litigate its validity and non-infringement. Such litigation ordinarily entails a considerable amount of expense and time. Secondly, the competitor may honor the patent claims and thus consider them as presenting a challenge to his inventive faculty to create new designs which lie outside of the fenced-in property of the patent claims. A new creation thus invented becomes a non-infringing device when manufactured, sold and used by the competitor. It is to be pointed out that the creation of an invention conceived by means of this "idea-generating tool" may be described as super-inventing.

Two Practical Applications of "Idea-Generating Tool"

The invention of the original wheel is shown below. A's claim covers and de-



Invention
of original
wheel by A



Invention
of eccentric
wheel or cam by
competitor B



Invention
of heart
shaped cam by
competitor C

Copyright 1954 by George V. Woodling

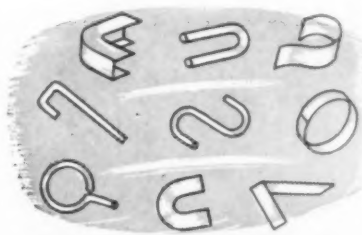
finer the structure and includes the words "a circular body having a central axis." Competitor B, weighing these words of limitation, "superinvents" a



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INDICATE A-6-180-2

The Tool Engineer

technical digests

wheel with an eccentric axis, which is non-infringing.

It is this procedure of honoring the original claim and designing around it which leads to the making of many worthwhile improvement inventions.

Competitor C finds that he cannot manufacture and sell concentric or eccentric wheels. He produces a heart-shaped cam which is free of infringement.

Most cases in actual practice are not so simple as these illustrations of the wheel and cams, but they do show how inventions may be made solely by the method of respecting prior patent claims and designing around them. It is this latter technique which constitutes the "idea-generating tool" used by most of the prolific inventors.

From a paper "New Applications and Designs for Patents" given before 1954 Machine Design Conference of The Cleveland Engineering Society.

Management Manpower

By Sydney Steele

Director, Planning Staff
Atlas Powder Co.

On technical manpower rests the double burden of contributing to the maintenance of national security and of maintaining and raising our material standard of living.

Sources

The major external sources of industrial manpower are colleges and universities, technical and vocational institutes, professional schools, junior and community colleges. From these sources industry recruits raw materials.

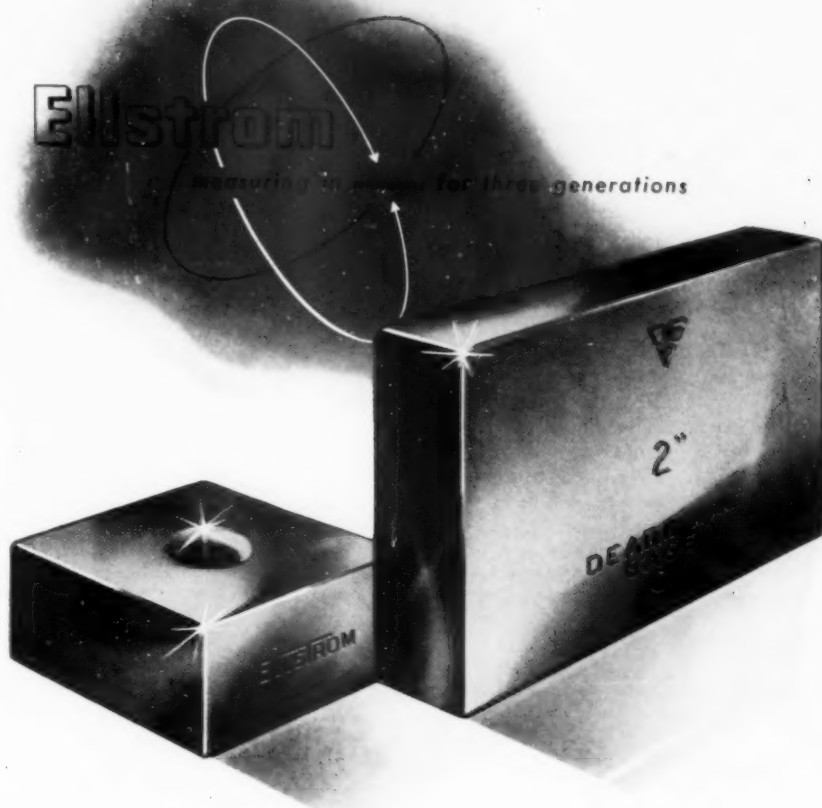
Industry's greatest manpower source, however, is internal—the millions of employees it has now.

Kind of Manpower

The kind of person coming into industry during the last fifteen to twenty years has been changing. Two unrelated trends are noticeable: one is declining scholarship, and the other increasing specialization.

There is a growing body of opinion that the decline in scholarship starts with a watering-down of public-school curricula and standards over the past 15 years and more.

While schools may be doing a reasonably good job of giving vocational training and a knowledge of social and economic problems, there is evidence that they are doing less well in training students to think clearly, and in giving them a firm grounding in the sciences and in the liberal arts.



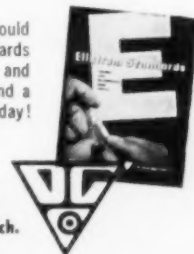
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The burden of many recent magazine articles is that there are too many specialists and too few generalists in industry today. And that specialists cannot be promoted beyond a certain point.

So, whether one looks at today's high-school graduate, or at those early graduates of the newer education who are now in mid-management, some serious flaws are apparent.

Supply of Technical Manpower

The number of engineers graduating during the next three years could not meet the estimated demand, even if all of them were available to industry. The armed forces are likely to take almost half of the engineers graduating in the foreseeable future. In round figures, 30,000 engineers are estimated to be

required annually for many years. The consensus is that less than half this number will be available to industry.

From the viewpoint of national survival, the relative situation is even more serious than is indicated by a direct comparison of the Russian and U.S. figures. A much larger proportion of Russia's technical manpower unquestionably is directed to work on military projects.

Use of Manpower

The continuing shortage of engineers has led to many methods for using our present engineering and technical personnel more efficiently. Among these methods are: improvements in organization; clear-cut delegation of authority and responsibility; decreasing the number of engineers per senior supervisor; planning groups to handle estimating, scheduling and budget control in engineering projects; better

work planning; help from subprofessionals; standardizing engineering procedures.

The development of men is the most important factor in the manpower situation. Emphasis will be on the long-range, not the short-range situation.

It seems that there are four important factors affecting the long-range development of men:

1. Manpower, is required, when employed to be specialized so that a quicker return can be realized on the investment.
2. It is comparatively easy for a man to progress as a specialist, at least for many years. Conversely, it is difficult for a man to broaden his experience by working sideways through the organization.
3. There is often a tendency to make promotion and salary increases depend on the manipulation of statistics by an unimaginative and unsympathetic mid-management.
4. Sometimes industry is too busy to make full use of a man's talents, training, experience and inclinations. A company should be on guard against short-sighted type-casting, which results in wastage, hoarding, or ultimate loss of manpower. In this, industry and Hollywood have something in common.

If Research and Engineering, Production, Sales, Financial, Legal or Human Relations Directors have had no experience outside of their field, where will a company get its next general manager or its next president?

Sometimes a company will elect to separate the sheep from the goats while they are still industrially young. But that does not contribute to good morale, and mistakes can be made. The same danger lies in wait, to a lesser degree, for a company which sends a selected few of its employees for training outside of the company.

One suggestion would be for the individual to approach management with a request for the opportunity to broaden his usefulness to the company, provided he can make out a good case. If, after a decent interval, the answer is "no" the alternatives are to remain a specialist with that company, or to go where the necessary broadening experience can be obtained.

The answer to increasing the number of technically trained people lies in expanding the whole college population. Of each 100 individuals with college ability, it is estimated that only 49 enter college, 37 graduate, and 2 go on to take Ph.D. and M.D. degrees. Here is a large reservoir which could yield additional technically trained men.

To increase the quality of manpower available to industry may be more difficult and time-consuming. A start can be made by seeing to it that our high-school and university graduates receive a more rounded education, so that they will be both educated and

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trained technically.

An increasing interest should be shown in liberal-arts graduates. At the moment, about nine out of ten business talent scouts are interested only in technical specialists.

To make better use of employees, it should be made easier for a man to broaden his industrial experience, provided he shows initiative and the other necessary qualities. This will require humanness at the top and at all of the intermediate levels. It will demand also a real interest in men and a knowledge of them as human beings. In turn, this will require a chain of perception and understanding as an integral part of the chain of command.

Perhaps the master key to the efficient use of manpower in industry was given almost 2,000 years ago in one simple rule, and most will agree (at least in principle) that it is necessary to deal with people as individuals.

From a paper "Manpower" presented before the 1953 annual meeting of American Institute of Chemical Engineers at St. Louis.



Pooling Automotive and Aircraft Tooling Experience

by Jack Slean

Heidrich Tool and Die Corp.
Detroit, Mich.

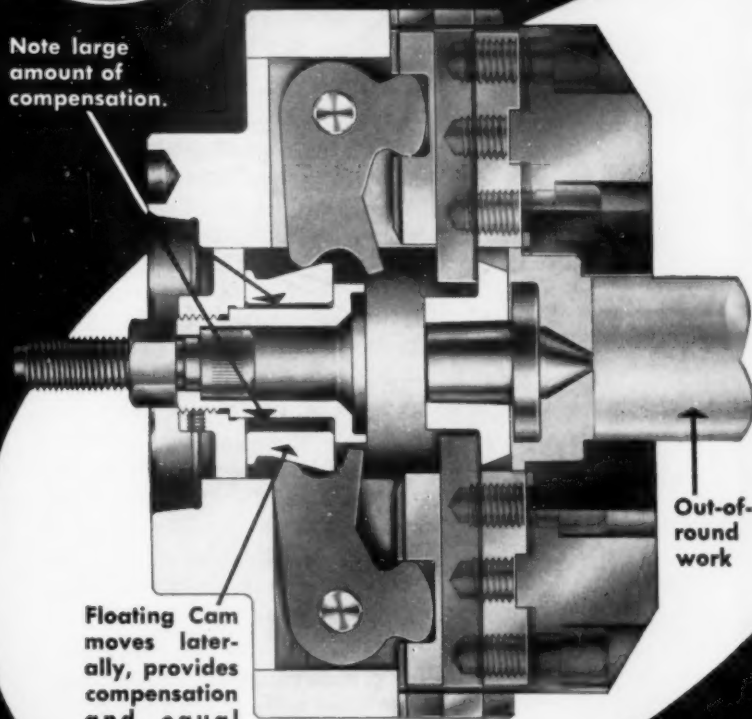
Despite differences between high geared automotive production and aircraft low production in assembly and engineering design procedures there are many similarities. A direct move should be made to more closely exchange their techniques and applications. Whether a reference is made either to centerline of car, normal top of frame line, front of dash or to water-mark lines, buttocks lines and station lines, they have the same significance to tooling engineers in either field.

An integration of thinking relative to engineering drawings should be approached for several reasons.

Aircraft engineering drawings are entirely different from those used in the automotive industry. Tooling shop personnel unfamiliar with them can become totally confused even though they may have had a number of years of experience in the automotive field. Aircraft engineering changes or deviations are not made part of the up-to-date working drawings. Therefore, a complicated screening process to determine

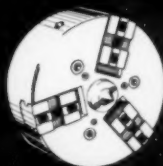
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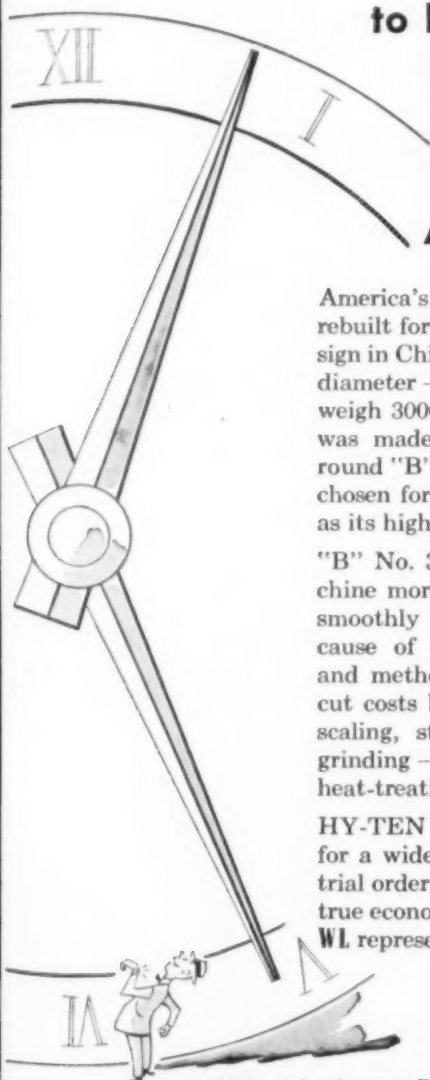
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technical digests

which changes are to be incorporated, which are to be deleted, and which are to supersede the others, often follows to determine the valid ones. The identical situation often occurs with templates and lifts. In comparison to this the automotive field maintains a steady flow of engineering changes or deviation date between design and their tool engineering divisions.

Acceptable tolerances between aircraft tooling and various phases of automotive tooling differ greatly. A segregation of actual tool fabrication is desirable until an interlocking system of standards relative to tolerances has been devised.

By allowing a gradual infiltration of men from the aircraft tooling into the automotive tooling and vice versa, a decided exchange of ideas or techniques are being applied advantageously. This would only lead one to believe that if an acceptable set of standards could be worked out that all parties would find greatly reduced costs the eventual outcome.

There already are some successful applications of techniques from one industry to the other. A number of parts previously produced by router blocks, routing, and drilling are now being produced by low cost blank and pierce dies, a method which has been greatly developed in the automotive field. This method previously was bypassed by the aircraft field, in many instances, because low production could not absorb the high cost tooling method. The production of highly contoured parts, conducive to draw dies originally developed in the automotive field, could not be justified for use in the aircraft industry due to exorbitant

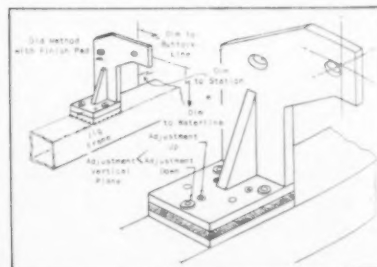


Fig. 1. Typical mounting of jig detail costs. However, through the development of less expensive methods of producing draw dies, namely Kirksite and plastics, a technique again has infiltrated from the automotive field into the aircraft industry. The original method for setting details for automotive body fixtures was by the exclusive use of vernier height gages and scribes for layout of location lines in relation to centerline of car, front of dash, and normal top of frame lines. The aircraft

technical digests

industry developed a method of setting the detail by the use of four leveling screws to obtain proper location. The detail is then locked with four screws and a permatrix shim back of the detail, Fig. 1. This reduces the number of manhours spent in complicated layout and reduces the cost of the tooling product, effecting savings for the automotive industry. One of the other major techniques having its inception in the aircraft industry was the use of photographic reproduction of lofts to produce shaped templates for model production, tooling detail location, and form reproduction. This method has been applied in the automotive field instead of the former complicated method of fitting and filing shape templates, and contour templates, to body draft layouts.

Optical tooling which has been developed and solely used by the aircraft industry has a multitude of potential uses in the automotive field. This method of setting and aligning details and assemblies, if properly applied, can effect substantial savings in automotive products. Its use in aligning of horizontal surfaces in relation to vertical or comparable horizontal surfaces, which have to be set blind to one another, can be accomplished through the use of optical aligning equipment, Fig. 2. This is one of the major tooling developments by which, with the application of extensive study, could result in more economy and more efficiency in both the automotive and aircraft industry.

From a paper entitled "Automotive Tooling Experience with Aircraft Tooling & Manufacturing" given at the 1954 SAE annual meeting.



Surface Tempering Caused by Grinding

by Gordon Murphy

Vice President

Foot Bros. Gear and Machine Corp.

Until rather recently few people recognized that sufficient heat can be generated during the process of grinding to produce cracks or changes in microstructure.

While investigating some grinding crack problems, some gears were experimentally etched all over to determine where significant tempering had occurred. Some dark areas and some light grey areas were found. Sectioning the parts disclosed that the dark areas showed tempering in worst cases

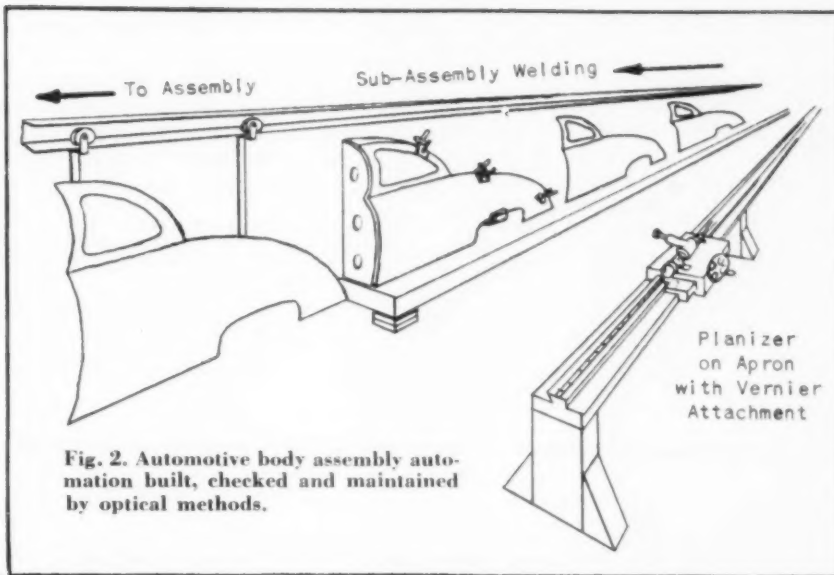


Fig. 2. Automotive body assembly automation built, checked and maintained by optical methods.



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as deep as 0.030 to 0.040 inch. The light grey areas were in all instances surrounded by dark tempered areas. The light areas were reformed martensite caused by heating the material above the critical temperature and rehardening it because of the rapid dissipation of heat by the coolants and the cold mass of the piece.

Such tempering on involute surfaces of gear teeth would contribute to premature failure. In root radii, where high stress concentrations occur, a soft

tempered surface would reduce fatigue life. Rehardened areas with accompanying high residual stresses present an even worse condition with respect to fatigue life. On involute surfaces it would aggravate pitting failures. Many factors which influence the results from grinding have been found. They are:

1. Type of grinding wheel (grit, size, bond, etc.). In general, softer, more porous wheels eliminate surface tempering.
2. Coolant. No one coolant serves all purposes. Oil is generally used for tooth grinding operations and soluble oil for external and internal grinding.
3. Wheel speed.
4. Wheel feed.

5. Uniformity of grinding stock. This includes considerations of distortion from heat treating as well as size variations in gear cutting or other machining operations involved.
6. Scaled or decarburized work which would tend to "glaze or load" the grinding wheel.
7. Human errors.
8. Wheel Sharpness. Sharp diamonds and a fairly rapid traverse across the surface of the wheel are necessary to produce best results. Dull diamonds and slow traverse tend to damage the grit and give a duller wheel.

Amount of stock removed from the wheel is also important. A wheel that is frequently dressed and not abused can be re-dressed by removing 0.002 to 0.003 inch. A badly glazed wheel may require removal of 0.015 inch to get back to a free cutting condition.

In general greatest difficulty occurred in tooth grinding with formed wheels where contact area was large and in grinding thrust faces with the side of a wheel. Bore grinding and external diameter grinding presented few problems. Tooth grinding free of surface tempering on machines that generate the tooth form with only line contact between the wheel and the work, was less difficult.

Until this time losses from cracks produced in grinding were a significant part of scrap. It was found necessary to set up etching facilities in grinding departments and etch 100 percent subsequent to gear tooth grinding and spot check all grinding operations performed on hardened material. Solving the surface temper problem eliminated grinding cracks.

The majority of the company's gears are carburized alloy steel with some experience with .40 to .50 carbon alloy steels hardened to 50 Rockwell C or harder.

No inspection is made for surface temper of nitrided parts since softening of nitrided case does not occur below 1250 deg and the brittle nitrided case is, therefore, more susceptible to cracking than to tempering.

Etching technique is as follows:

1. Degrease if work is extremely oily.
2. Alkaline Wash. For work with only soluble or grinding oil a commercial soak cleaning operation is sufficient.
3. Cold water rinse to cool the piece to approximately room temperature.
4. Immerse in 5-percent solution of nitric acid in water for approximately one minute.
5. Rinse in cold water.
6. Rinse in 10-percent solution of hydrochloric acid.
7. Cold water rinse.
8. Neutralize in alkaline solution. Use same solution as Operation 2.
9. Hot water rinse. Hold in rinse tank long enough for part to heat up to 180 to 200 deg.
10. Dry with compressed air.
11. Dip in rust preventative oil.
12. Inspect for indications.

It has been found unnecessary to

The last tenth is the troublesome one—

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remove the etched surfaces subsequent to inspection.

A significant tempering is not acceptable in highly stressed areas such as the involute surfaces or root radii of highly stressed gears. End faces and outside diameters of gears are not as critical.

Superficial hardness testing is one of the best methods of evaluating indications. If a temper indication is checked on Rockwell 15 N scale and found within hardness specifications, the tempering is shallow and for most application is probably acceptable.

Microscopic examination and hardness traverses of sections taken through indications are helpful in establishing acceptance standards.

From a paper presented at the 1953 semi-annual meeting of the American Gear Assn.



Producibility

by Harold M. Harrison
Lockheed Aircraft Corp.
Burbank, California

Attainment of producibility is stimulated by competitive forces. Great national interest in the cost of military airplanes focuses even more attention on potentialities of the producer. To reduce costs by all available means, aircraft firms are widely embracing maximum over-all producibility.

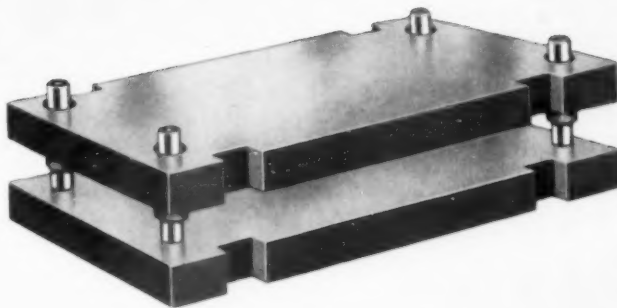
This includes producibility of the design and producibility of manufacturing. The latter involves physical characteristics of the plant, such as space, equipment, facilities; the character of the organization as a producing unit, the efficiency of its management, its over-all operation and systems, including those of the engineering department.

To attain maximum producibility, it is believed several qualities are necessary in an organization. Vision and foresight in the choice of a product for over-all suitability is a primary requisite.

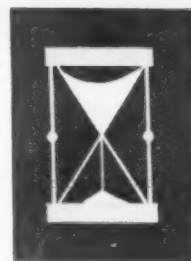
Costs

The ability to estimate costs and control the entire operation to them is essential. It is necessary to be able to detect immediately any signs of failure in cost performance as they appear and then remedy the ailments.

Although budgets must allow for all considerations, the targets set should offer a reasonable challenge to the factory. Direct manhours should be



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held to a minimum in fabrication by seeing that all machinery is operating to its optimum capacity. Too often speeds and feeds of cutting machinery are set below the capacity of the machine. Wise choice of cutting tools and holding fixtures aids in yielding the potential capacity of machines. Too often cutters designed for the working steel are employed for cutting light alloys, which results in the removal of metal at a mere fraction of the efficient practicable rate.

Ingenuity in design of tooling and holding fixtures and in simplified handling is a great advantage.

Keen forecasting of manpower requirements for each major job is needed. The introduction of that manpower in timely fashion will avoid un-

due piling up of manpower.

The appropriate standard of quality must be established and maintained for the product. Too high a standard results in higher costs than warranted. Parts and subassemblies of the proper quality assemble with facility and have a tremendous bearing on assembly costs.

Labor dislocations may be minimized by well-planned introductory programs especially when the use of new materials or methods is required. Training programs of personnel aid in reducing the amount of learning required. Avoidance of peaks and valleys in the overall labor load of the organization permits retention of trained labor for application to new projects.

Changes

Versatility of the entire organization on changes must be developed because

it has been proved that changes inevitably must be incorporated during the life of the model. Every effort must be made to keep them to an absolute minimum, imposing them at lot change points when feasible. Changes made to reduce costs must be examined cautiously because the losses due to the general disruptive influence and the loss of learning tend to postpone cost recovery so that intended gains may never be realized.

Controls

Regarding controls, means for depicting performance have evolved from experience but certain approaches have proven more fruitful than others. With the objective of meeting schedules at minimum costs, the schedule position and manhour expenditures require constant review. Manufacture of airframes involves a progression from the engineering design through the planning, tooling, and production release, to the fabrication, assembly, and delivery of the aircraft. Each station, or agency contributing to this progression or flow should have its work plotted to insure that the flow of incoming and outgoing work complies with the schedule plan.

The rate of flow scheduled is illustrated in Fig. 1 with the sequence required. The sequence of release from

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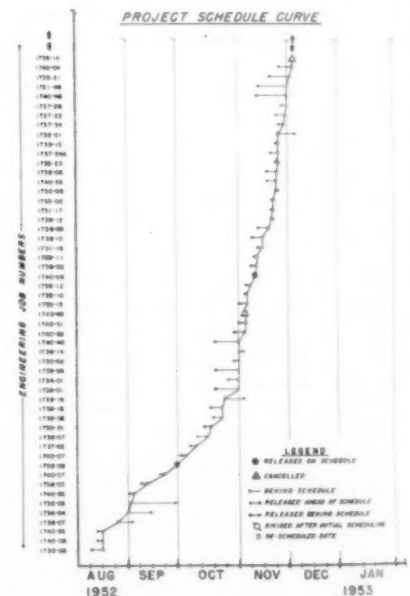


Fig. 1. Sequence and schedule chart.

engineering must comply with the sequence of the production schedule.

A manufacturing sequence chart is also valuable. The need date for each component is shown in relation to the other components. The release of jobs from engineering must correspond to the requirements derived from this chart.

The importance of detecting adverse trends and correcting them is pictured

technical digests

in Fig. 2. This depiction of shop orders released for the midfuselage of a prototype airplane illustrates methods applicable to production airplanes. The reading labeled "today" on this chart indicates that the "actual release" of orders out of planning is heading for a collision with the required "closure to stock" and that efforts must be exerted

SHOP ORDERS RELEASED
MID FUSELAGE

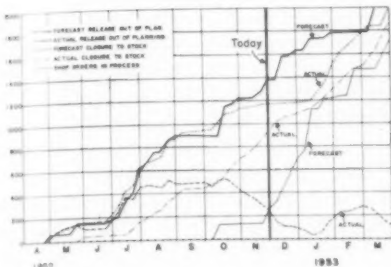


Fig. 2. Production scheduling chart.

to change that trend. It should be noted also that the shop orders in process are at too low a value to permit many closures. By exerting great efforts to bend that line, the "actual releases" changed in direction in barely sufficient time to allow manufacture of the parts and closure of them to stock to meet the schedule, as shown by the continuation of the lines.

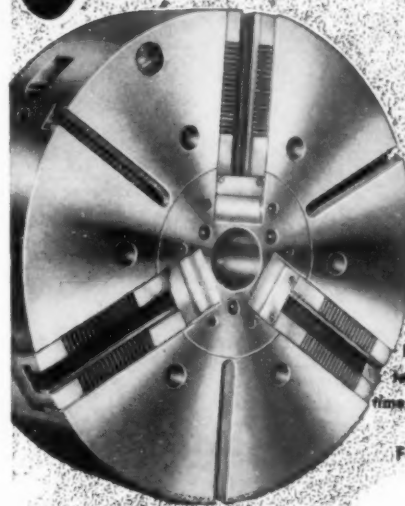
Immediate action must be taken when the wrong trend is detected because it takes considerable effort to overcome the inertia involved in these conditions. The work-in-process line shown on this chart illustrates that when that level is reduced too low, it is most likely cause for alarm and corrective action.

Another chart used is a composite of the primary interests of the operating heads. From it one is able to determine quickly the general status of the project. Factors plotted are:

1. Actual hours per equivalent airplanes produced compared with the allocated hours budgeted.
2. The rework hours per airplane.
3. The equivalent airplanes produced by week, scheduled and actual.
4. The accumulated equivalent airplanes produced, scheduled and actual.
5. The total number of men on the job is plotted as forecast by quarter and is plotted by the actual performance achieved. The overtime, or premium hours, are also plotted along this line as an area indication.
6. Fabricated and purchased part line shortages.

Readings taken as mentioned above give only part of the story. The number and percentage of part shortages must be watched. Unworkable orders, both tool orders and shop orders, must be tallied and broken down by responsibility. Premium or overtime hours by

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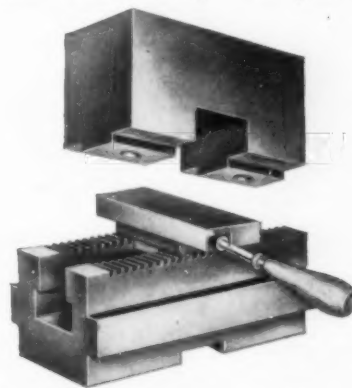
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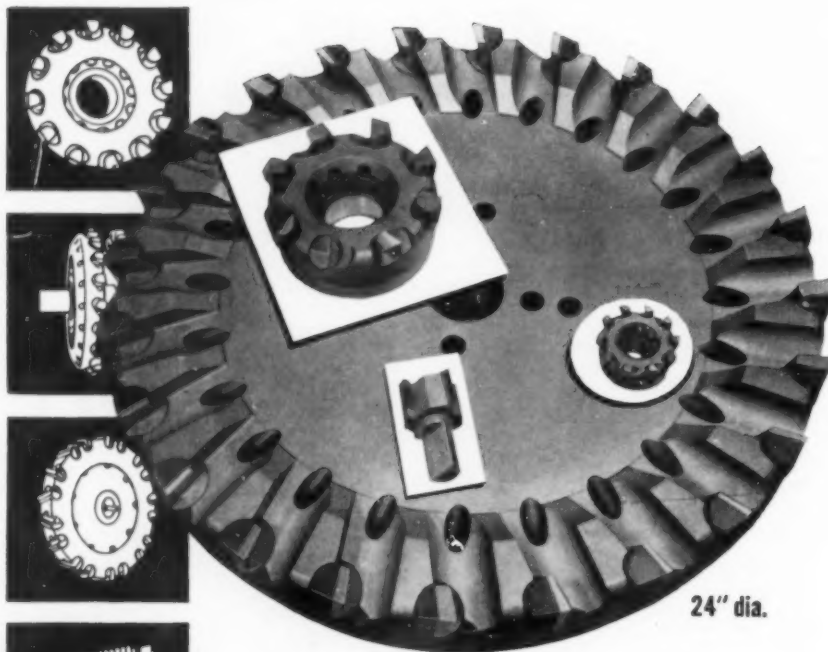
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major divisions should be plotted. Ratios of direct to indirect labor serve as clues to a proper balance. Labor turnover rates and "replacement hours worked" need attention. Orders stalled for any purpose must be kept under careful observation. For the control of costs one effective procedure is to review periodic reports of the actual hours worked in comparison with the standard hours allotted for each job. This actual ratio is the greatest single measurement in the control of manufacturing costs. It is necessary, of course, to see that lost time is held to a minimum, that manpower rendered idle while inspection occupies the work area, is tallied. Waiting for information to settle on the job engineering and tooling problems proves costly. Waiting for part and material shortages to be rectified, or waiting for machinery or tool repair proves costly and should be recorded. Also involved are costs stemming from employee transfers, safety instructions, union activities and even for such items as the waiting for clearing of the weather for flying.

Other controls are set up for the reducing to a minimum all the wasteful losses which drain on profits. Those avenues of loss often referred to as rat holes include such as the following which are charted regularly.

1. Rework hours and rework dollars by departments.
2. Processed scrap which not only involves spoilage, but trim, leavings, etc. This is plotted by pounds and by the percent of input of raw material.
3. Pounds of miscellaneous items received in reclamation.
4. Surplus from stock by number of parts by models.
5. Ratio of the jobs reworked to the jobs accepted by inspection in each department. And ratio of the jobs rejected for review by the salvage committee. These losses in rework hours are set forth in terms of the equivalent airplanes which would be produced by those manhours.

Policies of the company must continue to be consistent with the quality of character developed. Controls should continue so that their observance and administration according to the conditions revealed by them is segregated carefully by management levels. Thus, top management need review few reports and charts. Each operating head can determine the few essential to his own interests and so on down the line.

Solution of operating problems will always require much hard work, sound judgment, and wise decisions by every member of the management team.

From a paper given at the 1954 SAE annual meeting.

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technical digests

Yardsticks of Productivity

by Ewan Clague

Commissioner of Labor Statistics

U. S. Dept. of Labor

Viewed in its broadest sense, productivity is one of the great dynamic factors in any economic system. It measures the technological progress of industry and gauges fairly accurately the rise in the standard of living of the whole people.

Productivity measurement takes many forms. At one extreme is the attempt to measure output of a single worker. This is the area of time and motion study. While this is a continuing thing, there is no way to produce a summation of results that could be used for general economic purposes.

On a broader level studies can be made of productivity of a given plant and this is the field of cost analysis. Broadly, this consists of measuring the productivity of a given unit and summing up all the labor time used in achieving that production.

It is possible to broaden the scope of productivity measurement still further in attempt to gauge the progress of a whole industry. Such industry-wide summations are more a matter of general economic significance though somewhat less concerned to the individual company except as it is concerned with the comparison of its own status with industry as a whole. Other measures of productivity attempt to summarize it for groups of industries such as all manufacturing industries and finally, as the attempt to measure the productivity of the interned economy of the nation. Even this measurement can be done in different ways. One method sums up in physical terms the entire output of the economy. By another method the gross national product of the economy is used, as measured in dollar terms and deflated by the use of indexes of price changes.

Despite this varying scope the problem of measurement in all these cases has a common foundation, namely, data on output in all forms and data on labor input. Statisticians who attempt to devise the broader economic measures of productivity are able to build only on the detailed work that is done within the company or plant.

These measurements are being made all the time by cost accountants, engineers and methods personnel in plants throughout the country. Since virtually all labor-cost records are derived from man-hour data, there should be no major difficulties in using basic man-

hour data as another form of cost analysis. In the past few years there has been such a movement among a number of plants to keep records and make analyses using this man-hours as the base. Many people are gaining a better understanding of the vital potential contained in an hour of work and how the proper use of this potential can give a competitive advantage to the user.

Taking a group of plants manufacturing the same product, prices paid for raw materials, power and labor will vary little from plant to plant. When cost advantages exist because of

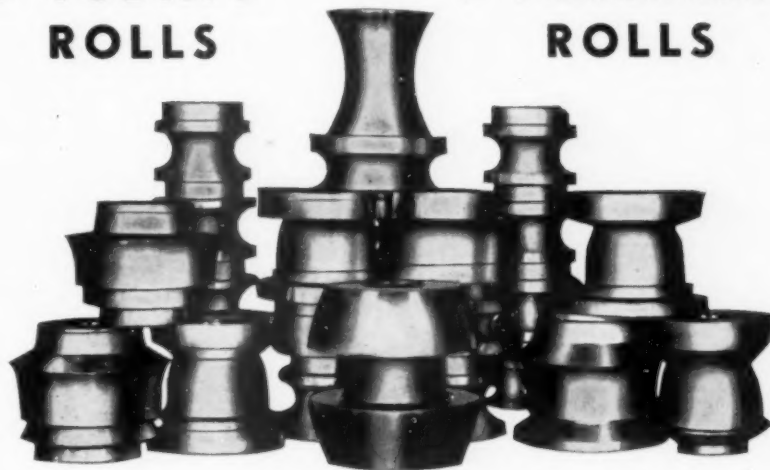
location or other fortunate circumstances, usually they can be maintained only for a short time and eventually disappear. Therefore, the individual plant's greatest opportunity for competitive advantage lies in the vital potential of an hour's work, but what is actually accomplished in a man-hour, varies widely from plant to plant within a given industry.

Several questions are raised by such studies of productivity. Why is the range greater in some industries than others? Why do low productivity plants with large amounts of labor continue to survive in the industry?



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Possibly wide divergences can occur in periods of inflation when practically all products are in heavy demand. In more vigorous competitive situations, probably low productivity plants with high labor costs would be forced out of business if they failed to take steps to improve efficiency.

Some companies with advanced accounting systems have not only recognized the value of analysis in terms of man-hours, but have actually designed departmental budgets in man-hour

terms alone. A departmental foreman is shown the number of budgeted hours allowed him for the coming months for a given amount of production. In many cases it is found this concept is easier to work with than a budget expressed in dollar terms.

Interest by business enterprises in productivity is by no means limited to analysis of man-hours input alone. The Labor Bureau has had indications of much sound work carried on by industrial economists in an attempt to establish practical techniques, including materials, supplies, power and plant charges in the productivity equa-

tion of manufacturing enterprises.

Industry and labor have been increasingly interested in recent years in productivity measurements such as the various indexes issued by the Bureau of Labor Statistics. This arises apparently from the general recognition that productivity, real wages and standard of living are basically derived from growth of technical progress and rise in productivity. The accompanying chart shows extent to which real average hourly earnings of workers in manufacturing industries was

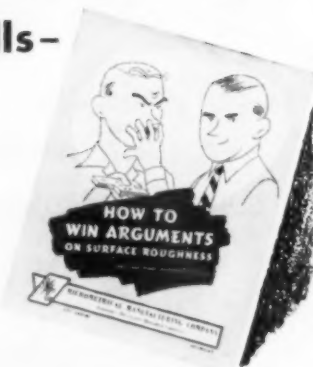
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correlated with the rise in output per man-hour from 1914 to 1939. It is evident that in the long run rise in real wages has been sustained by productivity increases. Real wages cannot increase faster than productivity nor on the other hand can they fall too far behind. The pressure of rising wage rates on the employer undoubtedly contributes to mechanization.

The Bureau of Labor Statistics, in addition to its domestic studies, has on a number of occasions made rough estimates of working time required by Russian workers to buy food and other consumer goods. The results from such widely published studies have indicated that the Soviet leaders have starved the Russian people in consumer goods in order to expand factories and capital equipment. The proportion of national income in Russia turned into creation of new capital goods is certainly tremendously higher than in the United States. It may be that the Russian threat will take the form of a race for production—a build-up of industrial potential of their economy. If so, this country cannot ignore the importance of increasing productivity. Can the lead in this field be maintained or at least can American industry keep ahead of Russian expansion? The answer may be vital to survival. For this reason it is important to keep productivity at the forefront and to devise measures to keep the nation informed of its progress.

From a speech given before the Annual Meeting of the American Institute of Chemical Engineers, December 1953.

Adapting Machine Tools to Aircraft Manufacture

By W. L. Davis

Plant Engr. Electrical Supervisor
Douglas Aircraft Co., Inc.
El Segundo, Calif.

Machine tools for aircraft construction are essentially the same as those used in other industries. By making alterations to some standard machines certain tasks may be more easily accomplished. Operational requirements and other circumstances dictate field alterations to some equipment.

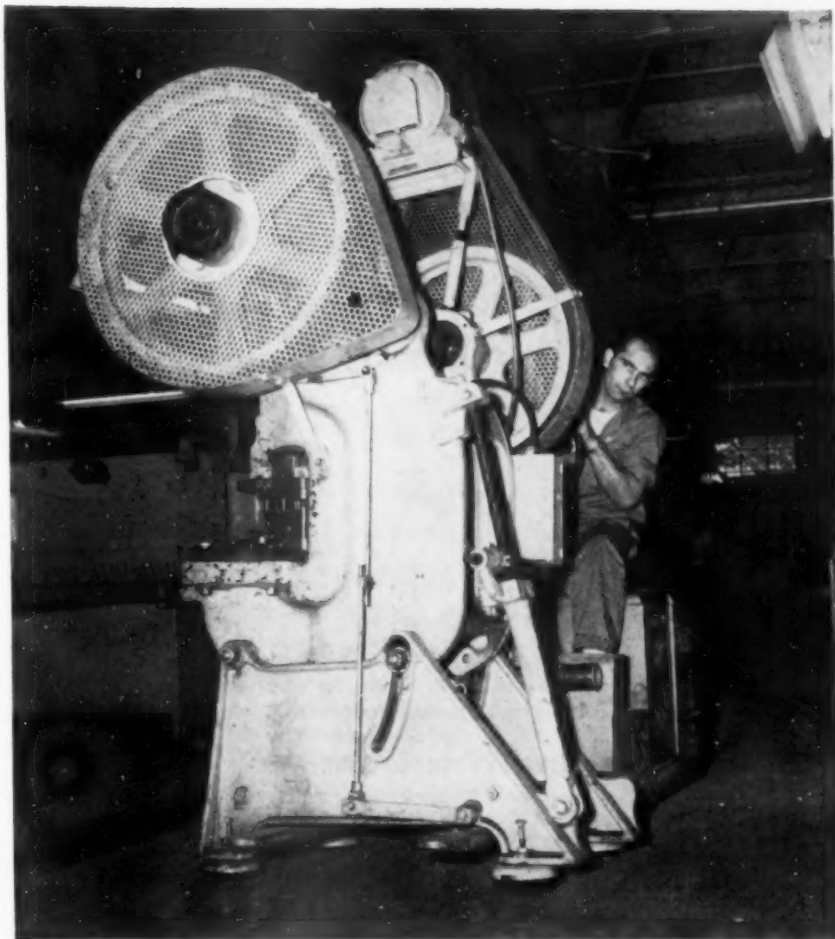
It would benefit aircraft manufacturers to have starter and control enclosures designed to permit interchange of equipment so that each purchaser may use his preferred make of control thereby reducing maintenance stock inventory. Enclosures ought to be oil and dust tight, so that machines may be located any place in the plant without danger of contamination.

Gear trains should be reduced by the use of multispeed or variable speed motors. This would assure that a greater percentage of the motor horsepower would be available at the cutter. Greater horsepower at the cutter would offer much better utilization of carbide tools for machining tough metals. If multispeed motors are used they should be properly engineered so that speed changing will not damage machines or parts.

The following machines need to be adaptable to hot forming operations: hydraulic presses, punch presses, drop hammers, air stamps, stretch presses, and power brakes. The gage and type of material being formed does not retain heat for any length of time, consequently dies or tools must be heated. Equipment should be capable of functioning properly where die or tool temperatures may go as high as 400 F. Heat losses through the machine should be held to reasonable limits.

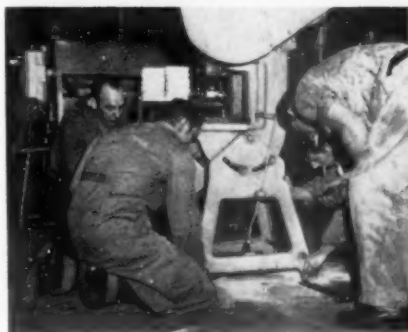
The aircraft industry is proud of its safety record. It is natural that all incoming equipment is checked for safety. Additional protective devices are often installed before equipment is put into operation. Motor plugging equipment has been added to circle saws, high-speed mill and router motors. The plugging feature, by stopping the cutter except during actual cutting operations, improves the safety rating of the machine and increases the potential output by speeding adjustments and retooling.

Shop orders for airframe parts are



NEW "NO LAGGING" METHOD CUTS COSTS. This 45-ton Perkins press was moved 200 feet — and was back in production in only five minutes, because the press was equipped with Leveling Barrymounts.

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OLD "BOLT AND SHIM" METHOD INCREASES COSTS. This 10-ton Press-Rite press was also moved 200 feet — but cutting bolt holes, setting lags, and driving shims took 33½ minutes. Can you afford it?

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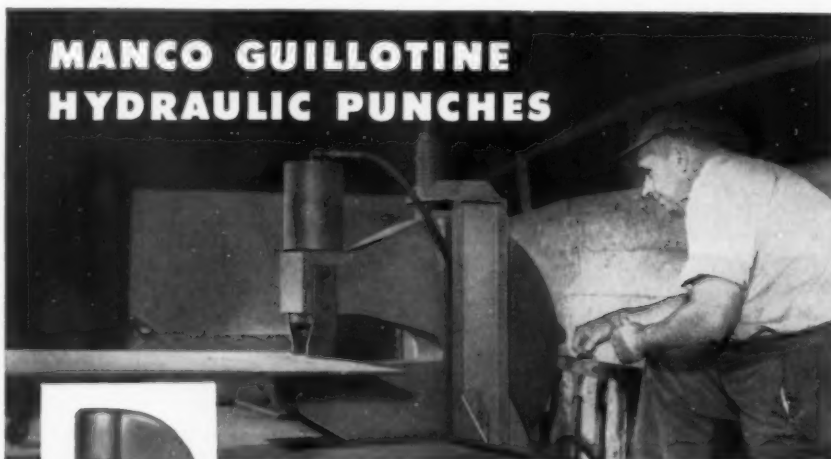
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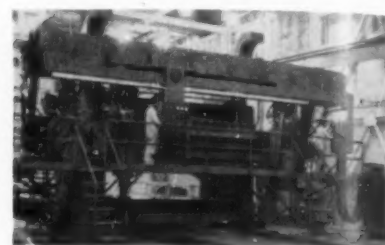
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Bradley, Illinois

technical digests

issued in relatively small quantities. This means that production machines undergo numerous setups during a shift. Motorized adjustments on power shear back gages, punch presses, sheet rolls, power brakes, hydraulic presses and other equipment would fill a serious need.

The forty-foot skin mill shown is an



example of special equipment developed for the building of airplanes. The machine tool industry may be proud of this and other design advancements. Special flushing and coolant circulating provisions are required to handle the volume of chips produced. The floor grating around the base of the machine covers troughs that flush the chips to a settling basin, a chip conveyor removes the chips from this basin. A sump pump returns the coolant to the flushing system. Ten limit switches were added to this machine to relieve the operator of some responsibility in controlling the action of the three cutter motors.

Modifications have improved spar milling functions. A kilowatt meter for each cutter motor was added. Greater utilization of cutter and motor capacity may be realized without danger of overloading. Motor rewinds and cutter damage have been materially reduced by the use of these instruments to determine motor loading.

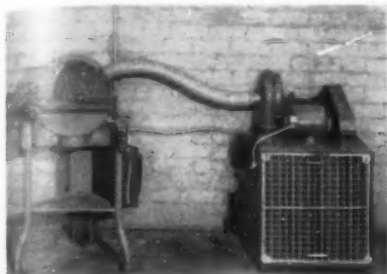
A specially designed and built 360 cycle motor shown in accompanying photo routs up to 3/4-inch aluminum alloy sheets. It has a circular, open-top enclosure. Chips and smoke are pulled down through the floor grating to a separator and chip chute.



The Tool Engineer

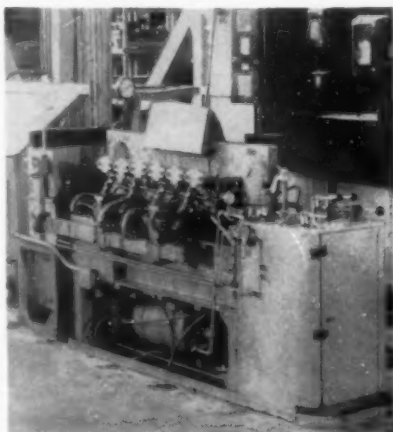
technical digests

The disk grinder and dust collector illustrated represents an undesirable type of installation. If the dust collector were an integral part of the grinder, floor space could be saved, less installation time would be needed and a neat arrangement would result from this



change. Similar equipment such as belt grinders, spindle sanders, small bench grinders, etc. should be provided with appropriate dust collecting equipment, not small undersized units.

The accompanying photo shows a machine specially designed and built for stretch forming small sheet parts. Ends of the sheet are clamped in jaws on front and back of the machine and the die on the pressure bar is hydraulically raised into the clamped sheet. Magnesium and other types of material are required to be hot formed. Resistance heating of the sheets seems to be the most practical method since the material has to be manhandled during the loading operations, and additional heat may be required while forming.



The transformer at the left end of the press supplies current to copper braid on the air-operated clamping jaws on both sides and the circuit is completed through the material to be heated. The console to the right houses hydraulic and pneumatic controls for the pressure bar cylinders and jaw clamps.

Production of form blocks is one of the bottlenecks that plague the airframe industry. If a standard machine tool were available that could finish mill

form blocks from a saw cut plate many of present operations could be eliminated. Such a mill should be capable of operating through a range of plus or minus 20 degrees from perpendicular to the base. Control of contour and bevel should be obtained from lines appearing on photo-print detail.

Another machine needed is one that would rapidly, accurately and economically produce helical templates. Long spar mills with multiple carriages dictate this development.

From a paper presented at the 1953 AIEE Conference on Machine Tools, Cleveland, Ohio.



New Extrusion Techniques

by H. Albers, Chief Engineer

G. Krause, Chief Designer

A. Greensite, Design Engineer

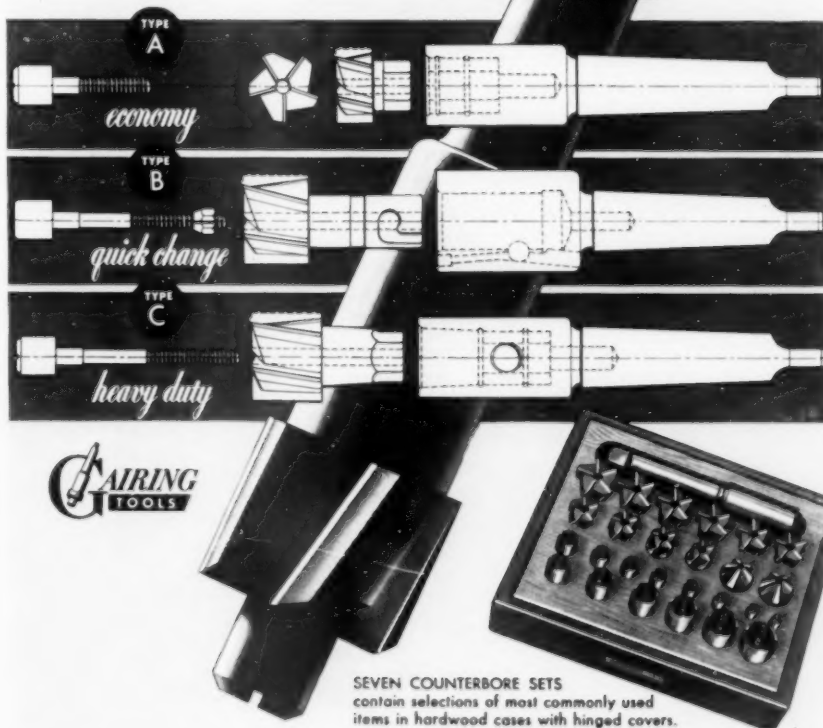
Loewy Construction Co., New York

One of the many reasons for the wide recognition of the extrusion process in recent years, is the realization that metal shapes fabricated by this process acquire a combination of properties afforded by no other means. The chief advantages are in the inherent ability of the process to produce, in a

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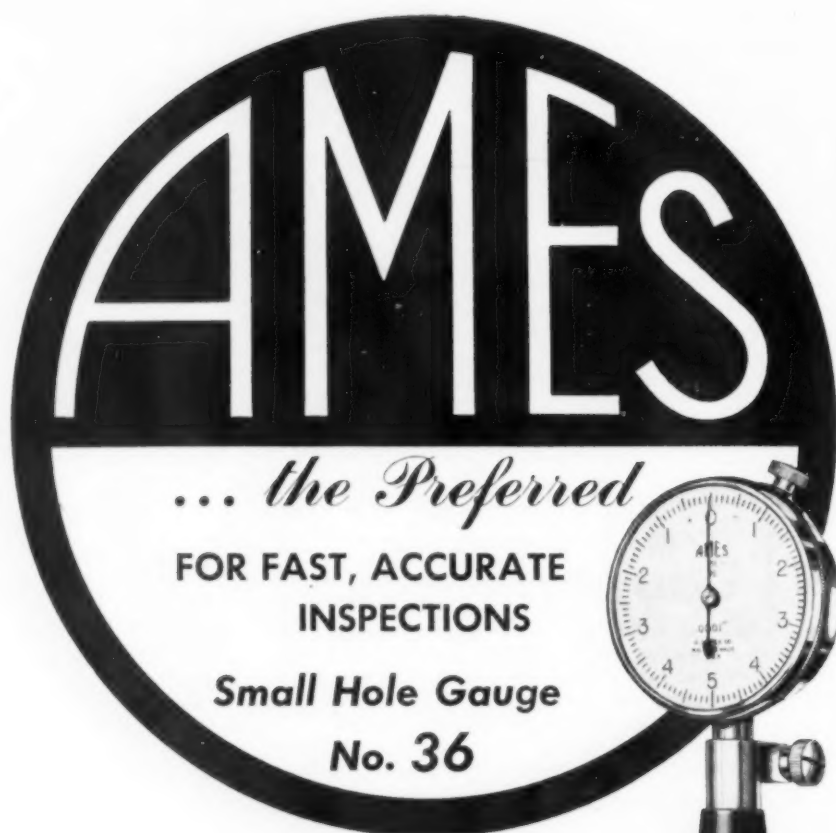
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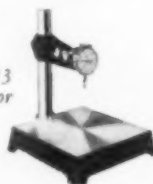
The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of $1/32"$, can check holes of $3/16"$ to $1"$ diameter, up to $2"$ depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

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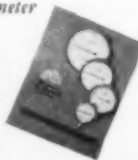
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technical digests

rapid and economical manner, parts of excellent physical properties and high dimensional accuracy, requiring little or no subsequent machining. The extrusion process is especially suitable for mass production methods. Rod, strip, hexagons, squares, tubes and an innumerable variety of solid and hollow shapes can be produced on the same press, by merely changing the die.

It is evident that the installation of the heavy extrusion presses will afford the aircraft designers, and later the machine designers in heavy industry, a far greater latitude in design than was thought possible until recently. However, new advances in extrusion technique, some of which are still in the drawing board stage, will extend engineering horizons even further. Extrusion, which until recently has been a process for producing a predetermined shape in straight lengths of uniform section, is now being developed whereby sections may vary in the longitudinal direction by being stepped or tapered.

The process is used in forming projectile shells from round billets; the essentials of this method are shown in Fig. 1a. A billet is placed in a container

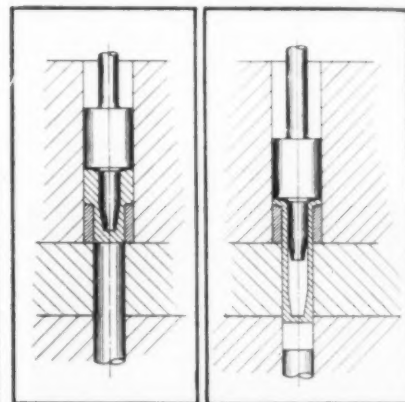


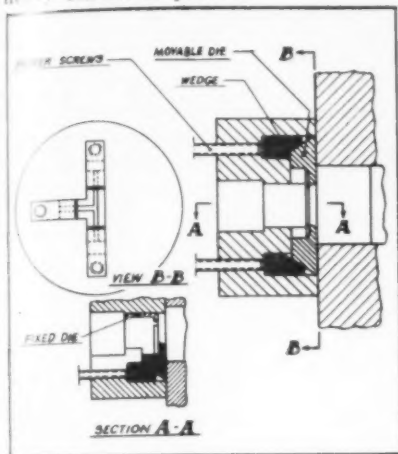
Fig. 1. (a) Round steel bar at 2000 F is placed in die. (b) Punch advances to extrude the metal through die orifice. Machining is unnecessary.

and under the pressure of a mandrel the metal is forced into the die ring and assumes a corresponding shape. This is, in effect, a closed die forging operation. Next the backing ring is removed and the extrusion proceeds as shown in Fig. 1b, producing a hollow formed shell.

Perhaps the most radical departure from conventional extrusion technique is embodied in the design shown in Fig. 2. This utilizes split dies that are moved laterally during the course of the extrusion to produce a longitudinally tapered section. The figure illustrates the arrangement at the beginning of the cycle. The up-and-down motion of the split dies is controlled by power screws act-

Technical digests

Fig. 2. Split dies to be used in new heavy extrusion presses.



ing on the dies through the intermediate wedges. The motion of the power screws, and hence the dies, may be controlled. The fixed die is rigidly attached to the die carrier and provides a back-up surface to prevent extrusion of metal past the gap opened by the moving split dies. In the illustration shown, the dies are shaped to produce an I section, as shown in Fig. 3.

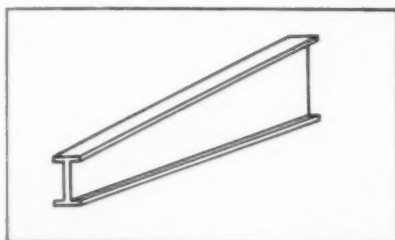


Fig. 3. One of variety of tapered aluminum extrusions to be produced.

By means of any or a combination of methods a wide variety of tapered extrusions could be produced. While these designs are still in the exploratory stage, the opportunities to develop and refine them will come as the new heavy presses are put in operation.

From a paper presented at the 1953 Annual ASME meeting.



Contact Molding of Plastic Parts

by C. A. McGill

Engineer, Lone Star Boat Mfg. Co.
Grand Prairie, Texas

The method by which a given item is to be produced is dependent upon the quantity, the requirements for physical properties and finish, size of part, its configuration, tooling costs and other factors. Among methods available for



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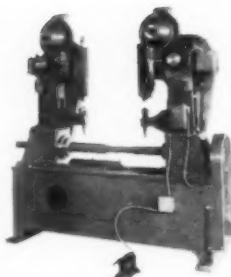
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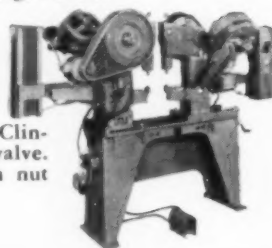
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technical digests

production of reinforced polyester parts is contact molding in which fibrous glass, cloth or mat is laid up in layers on a mold and impregnated with catalyzed polyester resin. Impregnation is accomplished by spraying or brushing the resin onto the glass and either brushing or rolling to remove air and to complete the wetting of the glass. Only contact pressure is used.

Contact molding is probably the cheapest way to build one reinforced polyester part. For some parts, it is the only practical means.

Probably the greatest advantage offered by the method is that in general, no large capital outlay is required. Molds are relatively inexpensive and can be made from almost any material, which can be worked to the proper shape and whose surface can be sealed, such as wood, plaster, concrete, metal, etc. Where long runs are anticipated, reinforced polyester can be used as the mold material. Phenolic tool plastic has been used on occasion. A typical female mold made of glass reinforced polyester resin is shown in Fig. 1. Such



Fig. 1. Resin is brushed into glass mat in an open mold in boat manufacture. molds can be used to produce hundreds of parts and can be duplicated easily from a master mold.

Techniques have been developed whereby quality laminates can be produced by hand layup. This fact, coupled with the low cost of molds makes contact molding feasible for production of many reinforced plastic parts.

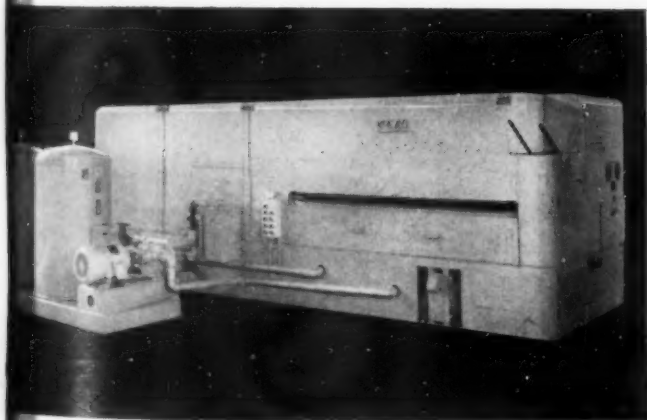
The method has definite limitations, however. Glass loadings greater than 30 percent are difficult to reproduce. Labor costs may cause over-all cost to be excessive. These factors limit the application of contact molding. The method does offer a means of producing parts in short runs which cannot be produced economically by a pressure method.

From a paper presented at the Technical and Management Conference of the Society for Plastics Industry, Inc., February 1954.

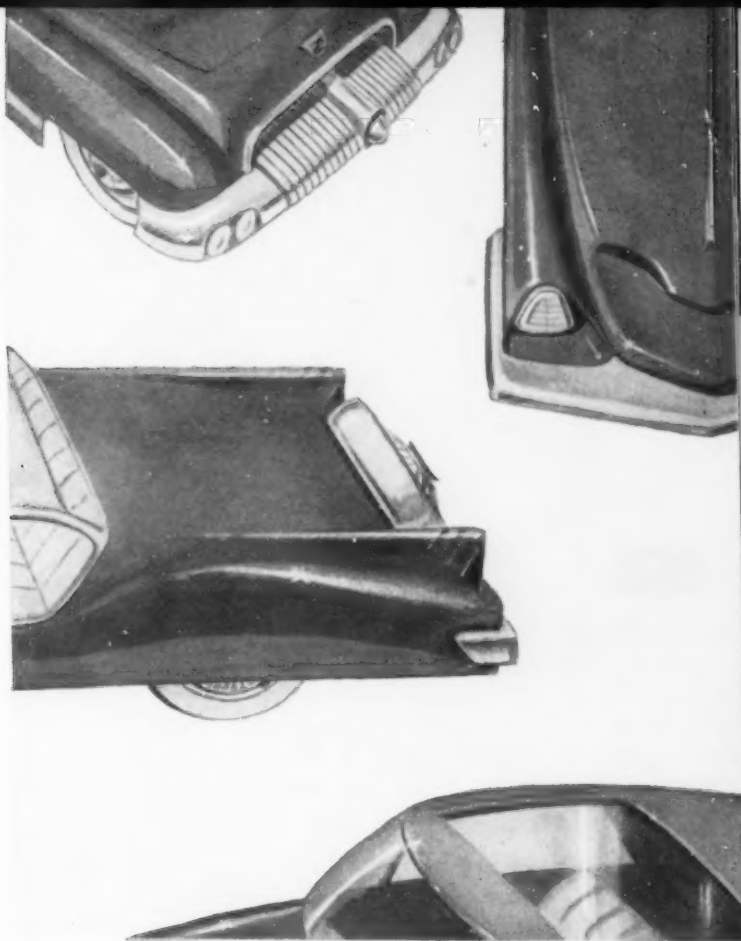


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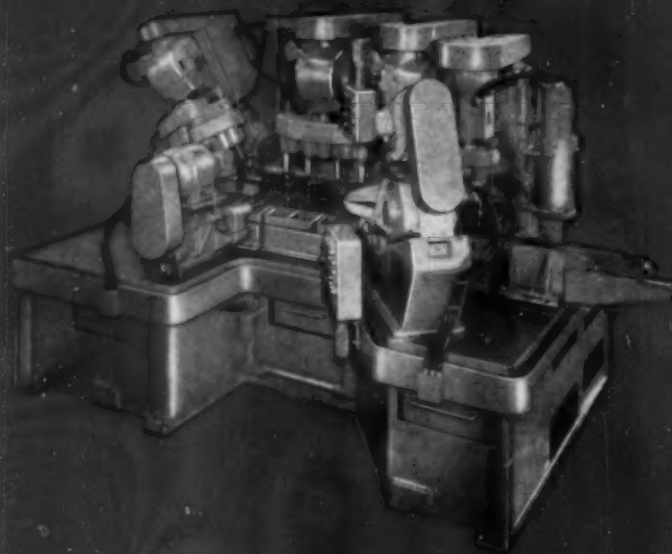
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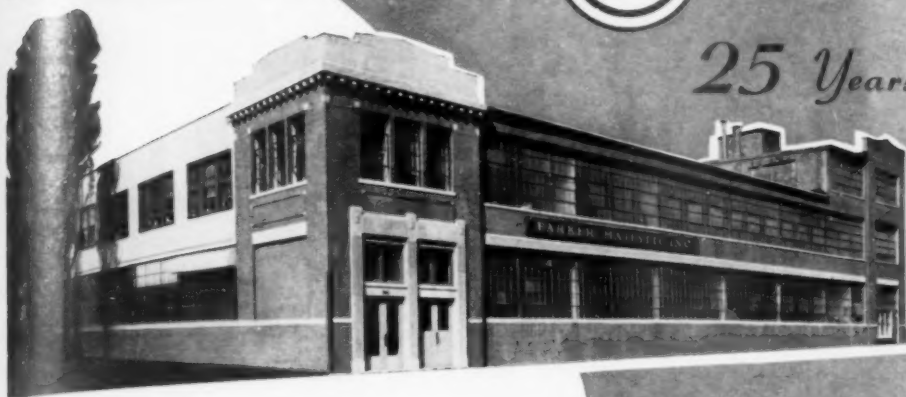
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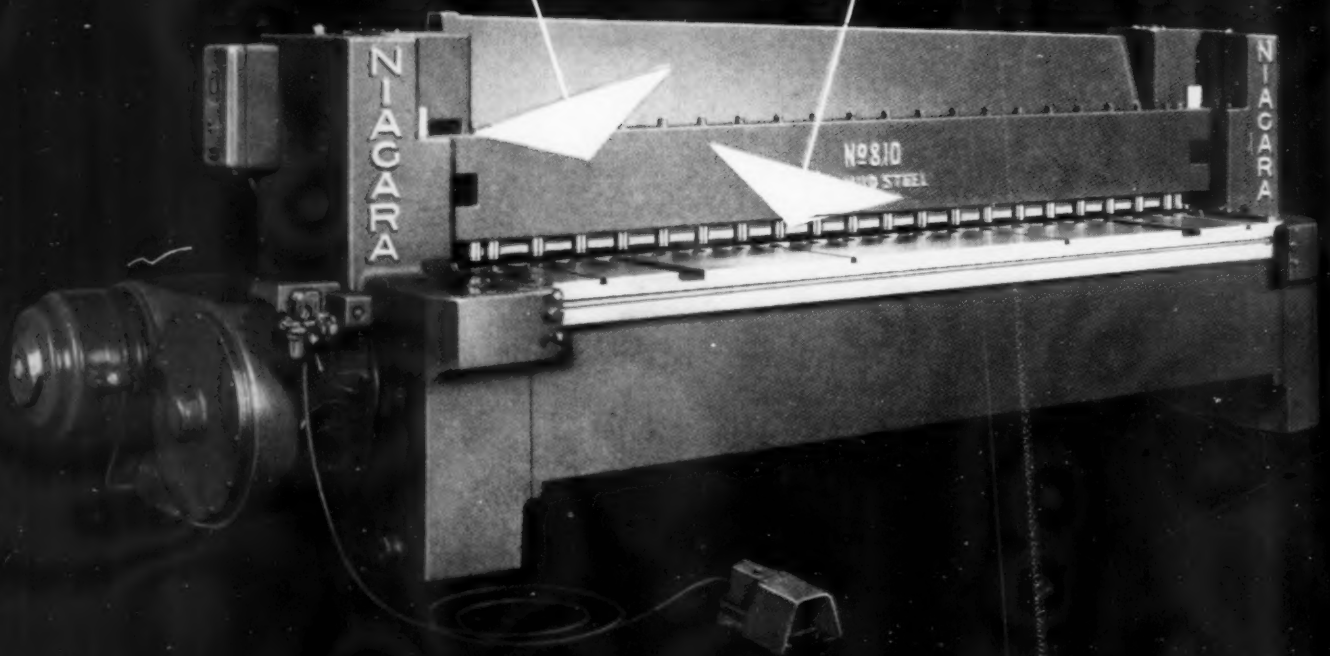


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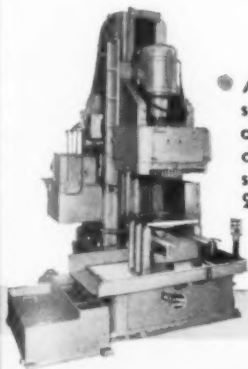
Builders of Better Machines Since 1879

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINING

AT W. F. & JOHN BARNES



- Special W. F. & John Barnes 15-Station Automatic "Progress-Thru" Machine built for an automobile manufacturer for machining cylinder heads. A total of 78 machining operations are handled automatically at a gross production rate of 117 pieces per hour. The entire unit, including hydraulic and electrical circuits, designed for easy accessibility.



- A typical small multiple spindle machine designed and built by Barnes — drills 40 — .332" holes simultaneously. Produces 27 pieces per hour.

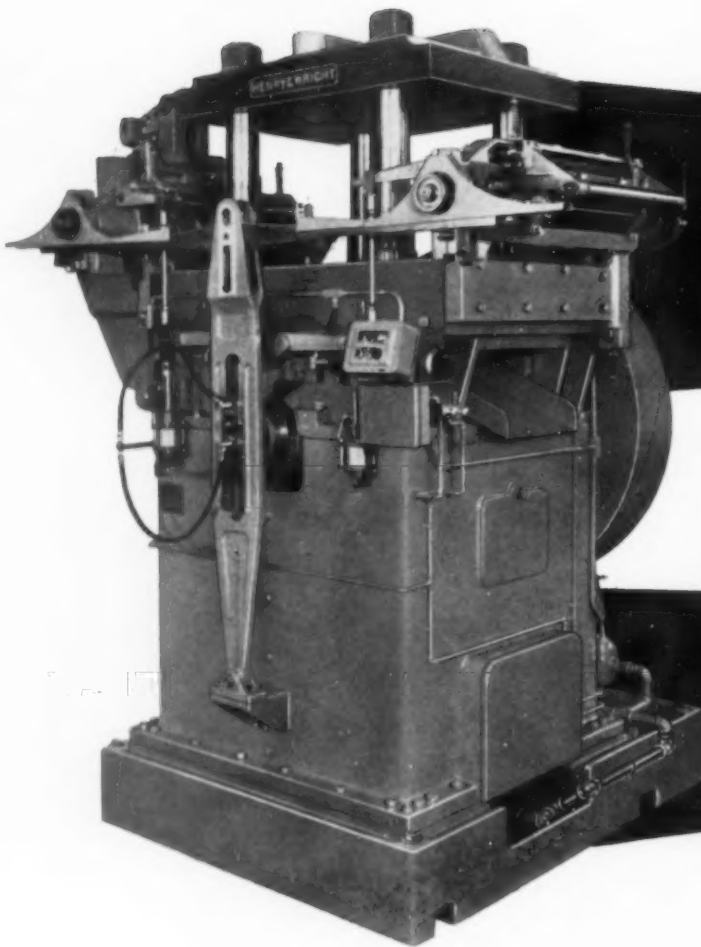
Write for Free Data

- Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service. Illustrates and describes modern machines and mass production techniques.



W. F. & JOHN BARNES COMPANY • 313 S. WATER STREET, ROCKFORD, ILLINOIS

MINI AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES



OVERTIME PRODUCTION

*in a
40-hour*

WEEK

If you have to produce more in a given time — the proven answer is a Henry & Wright Dieing Machine. Here is the capacity that enables you to keep pace with sudden scheduling changes; the consistent accuracy that permits you to set and automatically meet higher standards of work quality, while reducing cost.

In the Henry & Wright Dieing Machine, you have a production tool designed for high speed, built to widen radically the practical application of progressive stamp-

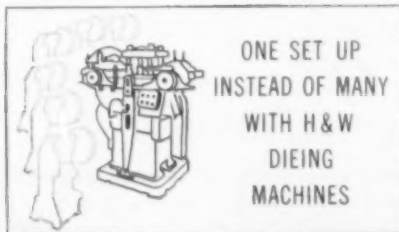
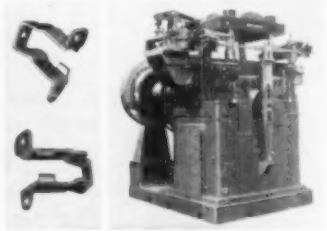
ing and engineered to prolong the life of your dies. Outstanding in its application for light and medium gauge metals, the Dieing Machine is also demonstrating that it can achieve equally extraordinary results in stamping and forming heavy gauge parts.

You owe it to yourself to include the Henry & Wright Dieing Machine in your plans for modernization, expansion or replacement. We welcome an opportunity to discuss its specific application to your requirements.



25-ton Henry & Wright Dieing Machines with twin die set-ups produced 435 parts per minute per machine at Barber-Colman.

200-ton Henry & Wright Dieing Machine producing 54 completed hinge boxes per stroke from $\frac{3}{32}$ " x 13" steel in coil form.



ONE SET UP
INSTEAD OF MANY
WITH H & W
DIEING
MACHINES

HELPFUL DATA is available in our fact-packed catalog which you can have by writing Henry & Wright, 421 Windsor St., Hartford, Connecticut.

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

HARTFORD, CONNECTICUT





IT'S SOLID . . ADJUSTABLE . . COMPACT!

Whenever you need an adjusting tap, but can't use a collapsing tap . . . especially where tooling space is limited and fast withdrawal not necessary . . . you'll find the **GEOMETRIC Class SJ Solid Adjustable Tap** ideal. This short, stubby tap will give you the advantages of fast adjustment to required decimal sizes or different class of thread and may be used for more than one pitch by the use of interchangeable chasers!

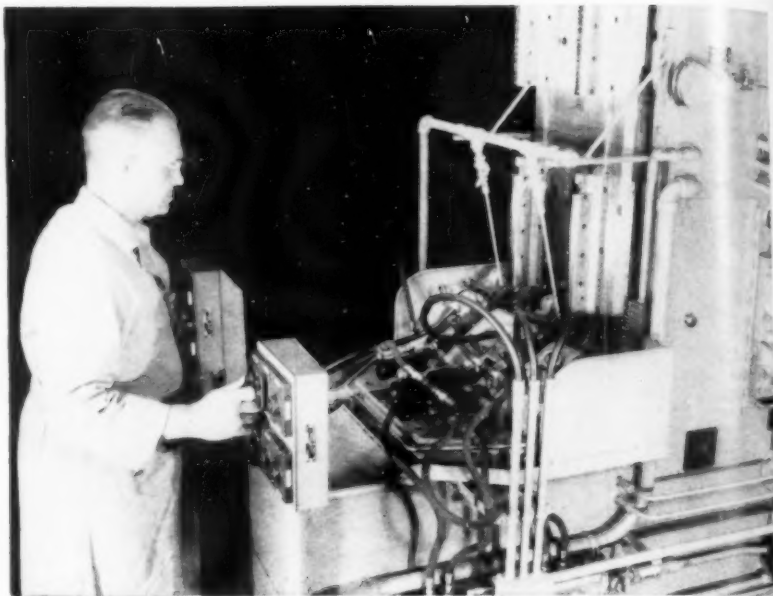
Class SJ taps available in eleven sizes covering the cutting range $1\frac{5}{16}$ " through $8\frac{1}{2}$ ".

Write for full details. Specify Bulletin SJ

Greenfield Tap and Die Corporation
GEOMETRIC TOOL COMPANY DIVISION
NEW HAVEN 15, CONNECTICUT



ANOTHER *American* FIRST



FIXTURE TILTS AUTOMATICALLY TO BROACH TWO PADS 70° APART IN ONE PASS

standard American machine and broaches, special American fixture solve problem

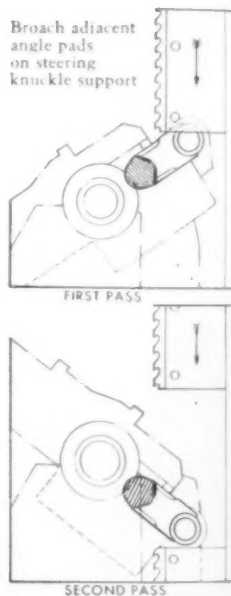
Two angle pads located 70° apart on a steel steering knuckle support are broached in one pass on a standard American vertical single ram surface broaching machine. A two station fixture on a receding work table is provided to allow for automatic tilting. Two broaches are mounted in vertical line for each station with a gap of about 12" between them. This gap allows clearance for the part to be tilted into position for broaching the second pad.

The operator loads two parts. The parts are then automatically clamped and the receding table moves into broaching position. The first pad is broached — then between the gap, the fixture automatically indexes tilting the part so that the second pad can be broached. The table automati-

cally moves back, parts tilt up and automatically unclamp, and the operator is ready to begin the cycle again.

American engineers are equally adept at designing machines, broaches and fixtures to solve your metal removal problems. Send a part print or a sample with your hourly requirements for a suggested solution. There is no obligation on your part.

American Circular 300 which lists all the standard American Vertical Hydraulic Surface Broaching Machines is yours for the asking. Write for it today.



American BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American First* — for the Best in Broaching Tools, Broaching Machines, Special Machinery



PEERLESS

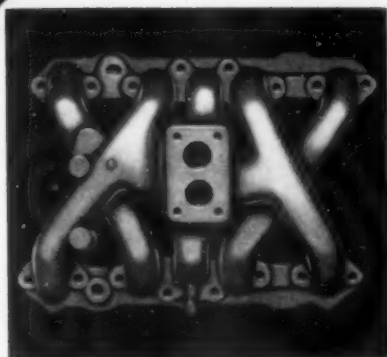
**ENGINEERING
EXCELLENCE**

*that does the
Never-Before*

NOW



*like this short Transfer
with Overhead Return Conveyor—
created to do a tough job in
minimum floor area!*



Part and Production: Intake Manifold for a new leading V-8 Engine. 180 pieces per hour at 100% efficiency.

Type of Specialized Production Equipment: 6-Station Automatic In-Line Transfer-Type Drilling-and-Tapping Machine with Automatic Overhead Pallet Return.

Tooling: Single-Place Pallet-Type Fixture with Manual Clamping. Anti-friction Drill and Individual Lead-Screw Tapping Heads.

BEFORE this PEERLESS, Plant Engineers were told that it was impossible to make a Transfer Machine which could be installed in such a small floor area.

NOW this PEERLESS, with specially-designed Overhead Pallet-Return Mechanism, is doing the job—setting a new high in maximum use of floor space!

Built to process all angular and bastard holes on Intake Manifolds, this PEERLESS was engineered for great flexibility—

Flexibility to take care of engineering changes if motor parts are altered.

Isn't this the kind of Engineering Excellence you want for your Specialized Production Equipment?

See other examples of PEERLESS Engineering Excellence that does the Never-Before, NOW!

WRITE FOR FREE 28-PAGE CATALOG

PEERLESS PRODUCTION CO.

19449 GLENDALE AVE. • DETROIT 23, MICH.

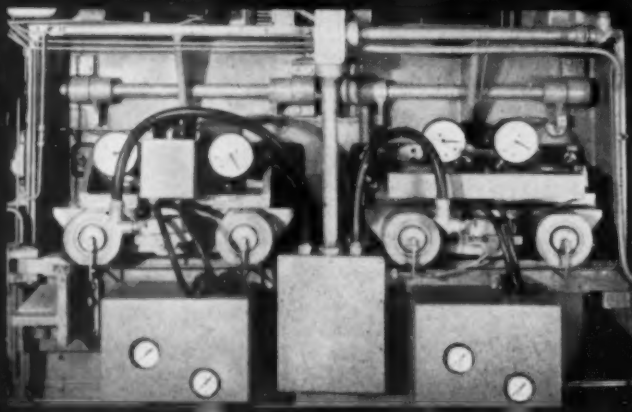
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TITLE _____
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STREET ADDRESS _____
CITY _____ ZONE _____ STATE _____

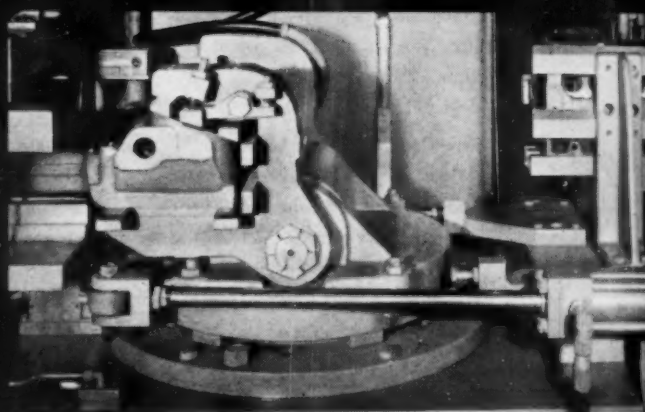
PEERLESS

SPECIALIZED PRODUCTION EQUIPMENT

NEW NATCO HOLEWAY machines...



AIR INSPECTION Stations No. 9, 29 and 30 of the first machine check reamed holes for diameter and location.



90° ROTATE and TURN Station No. 32 of the first machine rotates part 90° around each of two axes simultaneously for proper positioning in second machine.

ALL OPERATIONS COMPLETELY AUTOMATIC!

MACHINE No. 1 (35 Station)

- | | |
|----------------|-----------------------|
| 1 Loading | 1 90° Rotating |
| 14 Working | 2 Interference Relief |
| 4 Checking | 10 Idle |
| 2 Chip Dumping | 1 Unloading |

MACHINE No. 2 (25 Station)

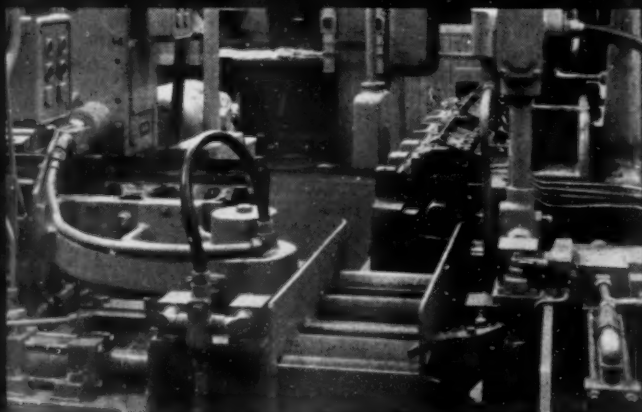
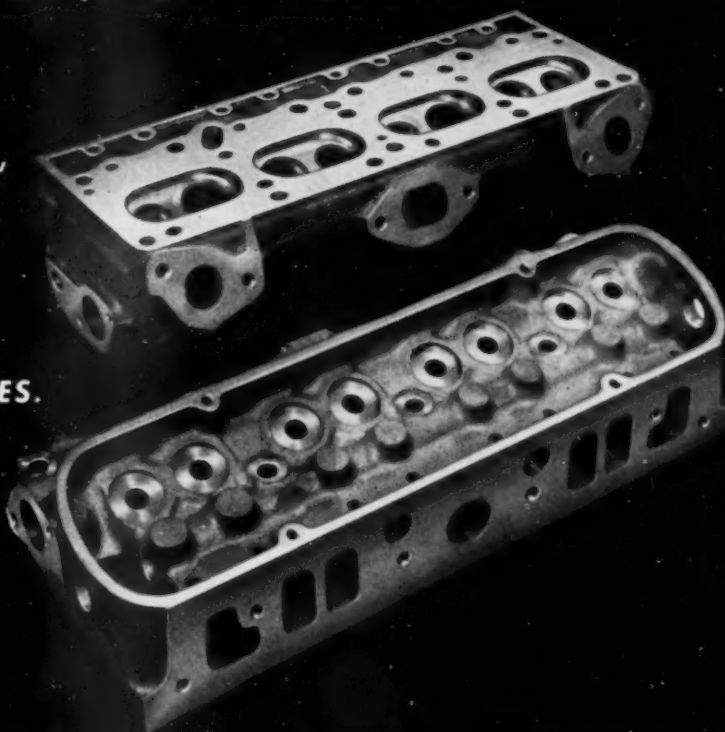
- | | |
|---------------|--------------------------|
| 1 Loading | 1 90° Rotating |
| 13 Working | 3 Idle |
| 3 Checking | 1 Ejecting and Replacing |
| 1 Air Testing | 1 Unloading |

... ANOTHER MACHINE

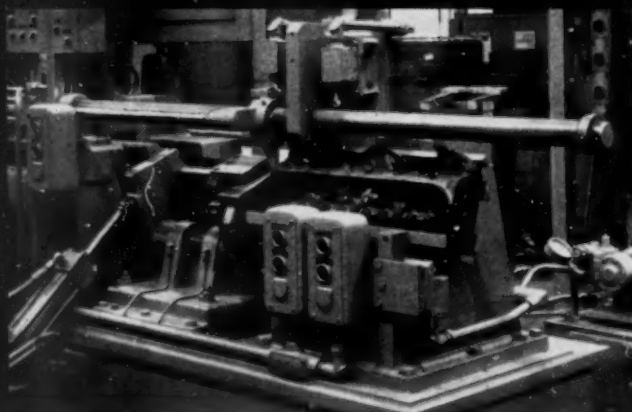
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ENGINEERED
for quality and
quantity production

106 CYLINDER HEADS PER HOUR AT 85% EFFICIENCY!

DRILLS, REAMS, MILLS,
CORE DRILLS, COUNTERBORES,
SPOT FACES and CHAMFERS
ALL SIX SIDES.
REMOVES CHIPS,
INSPECTS HOLE DEPTHS,
SIZES and CENTER DISTANCES.
CHECKS OIL GALLERY
HOLE and EJECTS
DEFECTIVE PART and
REPLACES WITH
SALVAGED PART.



REJECTION and REPLACEMENT Station 17 of second machine air checks oil gallery hole, automatically ejects defective part, station 18 automatically replaces with salvaged part.



70° ROTATION Station No. 24 of the second machine rotates part 70° to bring valve hole in horizontal plane.



Call a Natco Field Engineer

to help you solve your problems in
Drilling, Boring, Facing and Tapping



NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

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BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon



Here's help in ORDERING HYDRAULIC VALVES!

Use the form below to get specific information, prices, circuit designs and other data you may need on hydraulic valves.

Rivett catalogs 190 standard models in all popular sizes, types, actions, piston designs and pressures. Nearly any hydraulic valve requirement you may possibly have can be filled by Rivett.

And Rivett's Factory Engineers and experienced Sales Representatives will assist in planning the most efficient circuits for your operations.

We are interested in the Hydraulic Valves checked below.

☐ Send complete literature, specifications, and circuit information. ☐ Send quotations on items checked. ☐ Have our Rivett Representative call and supply circuit information. ☐ Our specific hydraulic problem is:

**Mail This Form Today. Or File
For Future Use!**

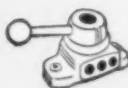
RIVETT LATHE & GRINDER, Inc.,
Fluid Power Division
Dept. TE-6, Brighton 35, Boston, Mass.

<input type="checkbox"/> Hand Operation: <input type="checkbox"/> Threaded Stem <input type="checkbox"/> Lever <input type="checkbox"/> Knob Action: <input type="checkbox"/> Manual <input type="checkbox"/> Spring <input type="checkbox"/> Ball Detent <input type="checkbox"/> Cam <input type="checkbox"/> Foot <input type="checkbox"/> Direct Solenoid Operated Mounting: <input type="checkbox"/> Pipe <input type="checkbox"/> Sub-Plate <input type="checkbox"/> Double Solenoid No Spring <input type="checkbox"/> Single Solenoid Spring Return	<input type="checkbox"/> Double Solenoid Spring Centered <input type="checkbox"/> Solenoid Pilot Operated Mounting: <input type="checkbox"/> Pipe <input type="checkbox"/> Sub-Plate <input type="checkbox"/> Double Solenoid No Spring <input type="checkbox"/> Single Solenoid Spring Return <input type="checkbox"/> Double Solenoid Spring Centered <input type="checkbox"/> Oil Pressure Operated <input type="checkbox"/> No Spring <input type="checkbox"/> Spring Return <input type="checkbox"/> Ball Detent <input type="checkbox"/> Spring Centered <input type="checkbox"/> Air Pressure Operated <input type="checkbox"/> No Spring	<input type="checkbox"/> Spring Return <input type="checkbox"/> Spring Centered <input type="checkbox"/> Oil Pilot Mounting: <input type="checkbox"/> Pipe Line <input type="checkbox"/> Base <input type="checkbox"/> Foot <input type="checkbox"/> Panel <input type="checkbox"/> Flow Control <input type="checkbox"/> Check Mounting: <input type="checkbox"/> Pipe <input type="checkbox"/> Flange <input type="checkbox"/> Spring Loaded <input type="checkbox"/> Pilot Operated <input type="checkbox"/> Pilot Operated with Pressure Breaker <input type="checkbox"/> Shut Off	<input type="checkbox"/> Deceleration <input type="checkbox"/> Relief <input type="checkbox"/> Unloading <input type="checkbox"/> Sequence <input type="checkbox"/> Direct Operated <input type="checkbox"/> Remote Operated <input type="checkbox"/> With Integral Check <input type="checkbox"/> Counter-Balance Sizes <input type="checkbox"/> 1/4, <input type="checkbox"/> 3/8, <input type="checkbox"/> 1/2, <input type="checkbox"/> 3/4, <input type="checkbox"/> 1, <input type="checkbox"/> 1 1/4, <input type="checkbox"/> 1 1/2 Pressures <input type="checkbox"/> 1500 P.S.I. <input type="checkbox"/> 3000 P.S.I. Specify Valve Action Desired
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NAME _____ TITLE _____
COMPANY _____ CITY _____ STATE _____



furnishes a complete power package

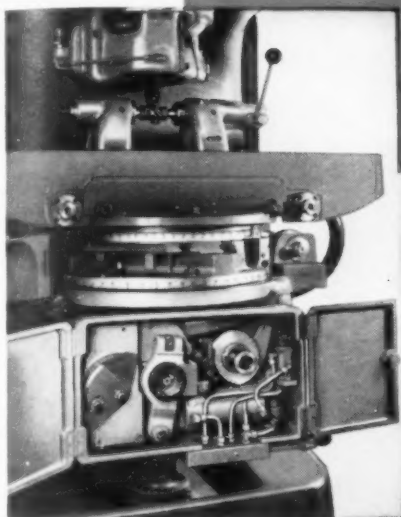


VALVES • CYLINDERS • POWER UNITS

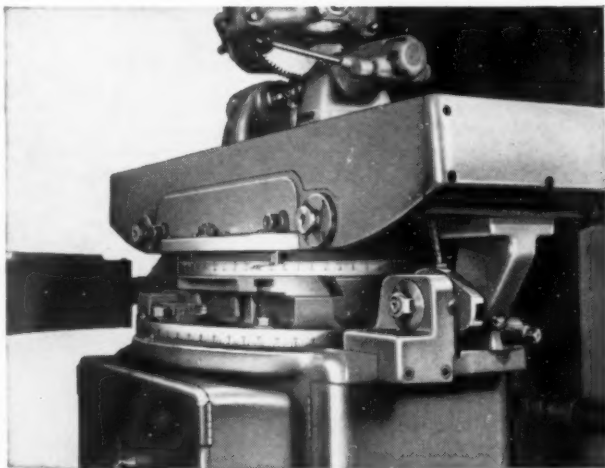
Air and Hydraulic
All sizes and types

An Important Contribution

To GEAR SHAVING PRACTICE



**Differential up-feed
mechanism**



Crowning cam and bracket

**SPUR AND HELICAL
GEAR SPECIALISTS**
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM



Two new features are now optionally available with the Red Ring Gear Shaving Machine Model GCU — Automatic Differential Up-feed and Conventional Crowning. So equipped, any of the recognized processes in the field of rotary gear shaving may be performed on this machine. It thus becomes economically applicable to both high production and to job shop operations and to gears of all characteristics within its size range.

Specifically the Model GCU with these additions can be used for:

- (1) Diagonal shaving at fixed center distance on a two stroke cycle.
- (2) Diagonal shaving on an automatic multi-stroke cycle with selected increments of up-feed and dwell.
- (3) Conventional shaving on an automatic multi-stroke cycle with selected increments of up-feed and dwell.
- (4) Precision gear crowning accomplished by rocking the table during any conventional shaving cycle.
- (5) Taper shaving to specification.

Automatic cycling is precise and very fast. Production rates are high and cutter life has been increased to as much as 200%.

Write for Bulletin S53-7 which gives all the details of this important new development.

6501

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



High Precision, Reliability, Top Performance

SCHAEFER

MODEL UN-450

HEAVY DUTY LATHE

SCHAEFER MODEL UN-450 HEAVY DUTY COPYING LATHES.

Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permits rough turning and finish turning in the same operation in many instances. Swings 17-3/4" over bed, 9" over carriage, 20-5/64" over gap. Center distance 60". Spindle speeds 31.5 to 1400 R.P.M. Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pump. A production lathe built to tool room standards.

OUTSTANDING FEATURES

Copies simultaneously in 2 directions; 49 longitudinal and cross feeds; All gears in headstock hardened and ground; Automatic carriage release when overloaded; Separate oiling systems for front and rear end bearings; Ball stop catch on cross slide guarantees accurate depth adjustment for thread cutting; Adjustable carriage stop for longitudinal turning.

- Guaranteed Service by Trained Staff
- Engineering Staff will make recommendations based on your requirements
- Spare Parts in Stock
- Your Operators Trained
- Early Deliveries — Some from Stock
- Competitive Prices
- Financing and Rental Plans to Meet Your Requirements

Many More Machines for Every Operation

Write for free illustrated brochure 100,
or state your specific requirements.

Representatives in the United States

M. B. I. EXPORT & IMPORT LTD.

A Division of Machinery Builders Inc.

Over twenty years experience in designing and building machinery

475 GRAND CONCOURSE, BRONX 51, NEW YORK

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CUSHMAN

gives you **CHUCK-ABILITY**

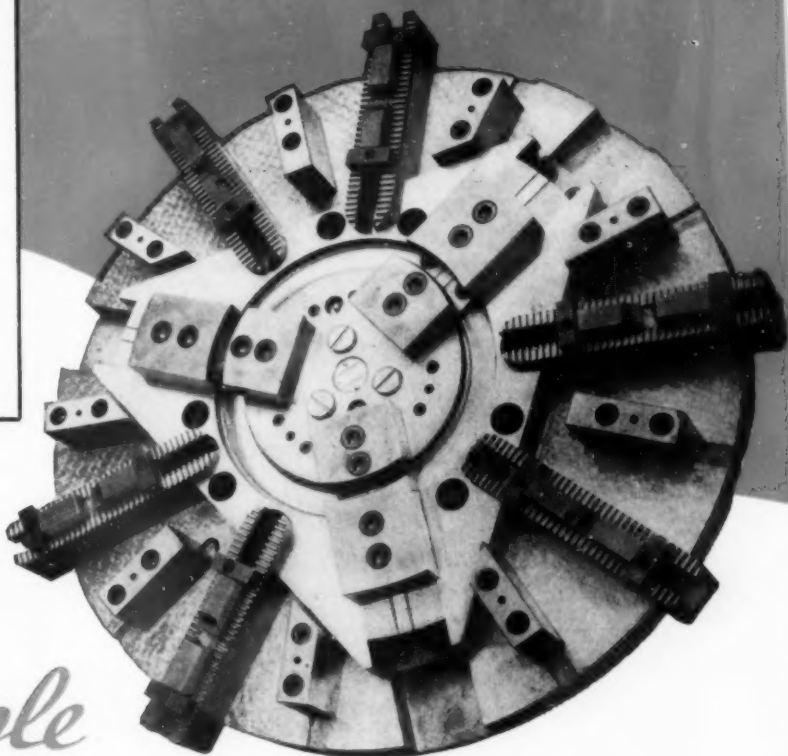


CHUCK-ABILITY:

The ability to **SPEED**
your work... **ELIMINATE**
fatigue... **IMPROVE**
your products... and
REDUCE your costs...
through design and
selection of the right
work-holding devices.

Remember-

You can't machine it economically
unless you hold it right



an example

... of this is the series of special chucks engineered and designed to hold jet engine discs and rings while being machined to exceedingly close tolerances. These jet engine parts, vital to our country's air arm, presented a major work-holding problem because of their large size and extremely small cross section. Until Cushman developed these special chucks, most forms of work-holding devices caused severe distortion difficulties. Design and engineering service such as this is always available to industry through the Cushman Engineering Department. Find out what Chuck-Ability can do for you... write Cushman for Special Data Book No. 852 describing Cushman Wheel and Ring Chucks.

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Manufacturers of

Air Operated Chucks, Cylinders, and Accessory
Equipment... The Cushman Power Wrench...
Cushman Manually Operated Chucks and Face
Plate Jaws.

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2 BUSHING STANDARDS

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Includes
7114
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Made to your Order...

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Cutting Tools

SPECIAL, HIGH-PRECISION
HIGH-SPEED STEEL & CARBIDE TIPPED

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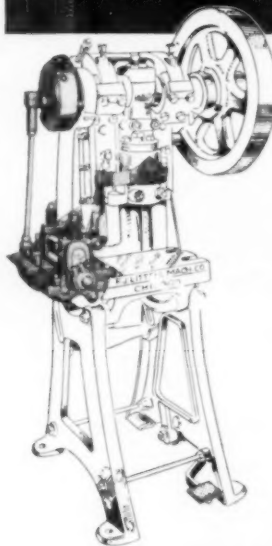


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Automation in Action . . .

LITTELL Style "M" ROLL FEED

Makes Any Punch Press Fully Automatic
and 3 Ways Better



• **FASTER** . . . 9,000 stampings an hour at 200 strokes per minute, or 4,000 stampings an hour at 100 strokes per minute are easy production rates on any press with Style "M" Roll Feed.

• **SAFER** . . . Automatic feeding with Style "M" Roll Feed keeps hands and fingers safe from costly accidents.

• **LOWER IN COST** . . . Faster, automatic production from low cost coil stock cuts cost per stamping. Greater safety gives your presses the lowest insurance rate.

The Style "M" Roll Feed is quickly and easily installed on any standard punch press. Several models are available—the largest feeds coil stock up to 8" wide and .055" thick. All models feed left to right, right to left or front to back. Feed direction is reversed by reversing the clutch. On large models, feed length per stroke is from 0 to 4 1/8" with standard gears, and from 0 to 8 1/2" with compound gears. Feeding rolls are hardened and ground for long service life. Style "M" puts automation in your press room at lowest possible cost.

Write for the Littell Roll Feed Catalog



Speed
with Safety

ROLL FEEDS • DIAL FEEDS
STRAIGHTENING MACHINES
REELS • AIR BLAST VALVES
District Offices: Detroit, Cleveland

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USE READER SERVICE CARD; INDICATE A-6-216-3

World's Hardest Metal

TOOLS

BLADES

ROLLS

DIES

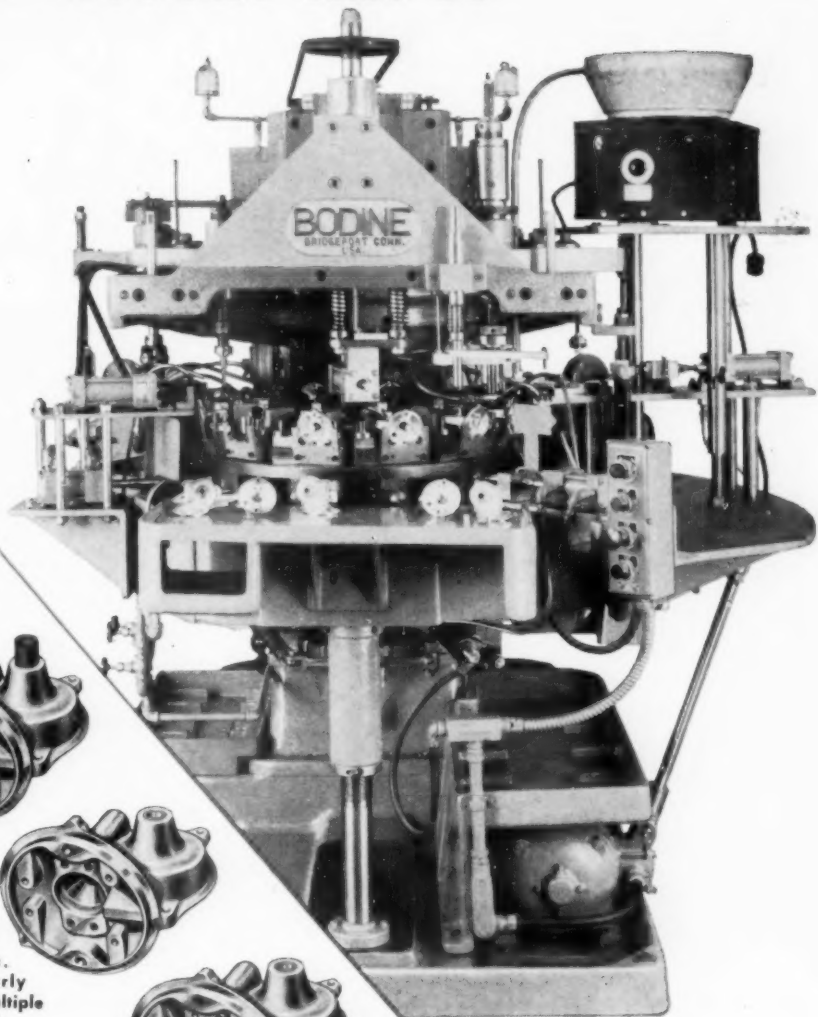
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Many times more durable than steel, Talide Metal adds years of life to the wearing edges of tools, dies, machinery and equipment. Hard as a diamond and almost indestructible, it triples output per man and per machine. For good service and recommendations for improving any cutting, drawing or wear-resistant application, send particulars to Metal Carbides Corp., Youngstown 7, Ohio. Write for Catalog No. 54-G

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HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-6-216-4

Bodine CASE HISTORY NO. 37



1 Hand-load part to clamping fixture.

2 Automatically position locking lever.

3 Inspect for part and proper positioning in fixture.

4 Automatically clamp.

5 Spot face $\frac{3}{8}$ " dia. maintaining depth to $\pm .002$ ".

6 Automatically hopper feed, transfer and insert Oilite bushing.

7 Drill 4 - #31 dia. (.120") holes and 1 - .1235" dia. hole (angularly transfer mounted multiple drill head).

8 Tap 2 holes #10-32 with angularly mounted 2-spindle tap head.

9 Size I.D. of Oilite bushing to .3735" - .3745" dia.

10 Automatically unlock and retract locking lever.

11 Hand-unload.

PROCESSING WINDSHIELD WIPER MOTOR HOUSINGS

PRODUCTION

One piece per stroke . . . 20 strokes per min.
— 1000 pieces per 50-min. hour. 10,000 individual operations per 50-min. hour.

MATERIAL

S.A.E. #925 Die Casting (Parts No. EMG-2, EMG-3, right- and left-hand).

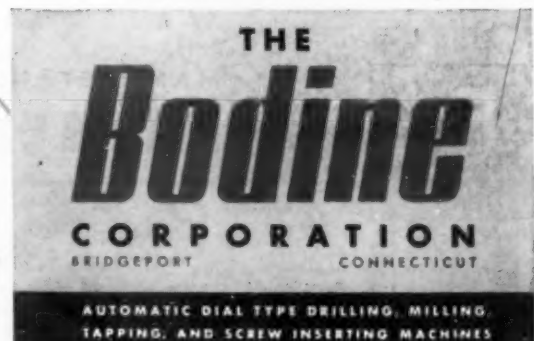
TOLERANCES

(Other than specified above) Drilled holes: Size .001".
Location: $\pm .002$ ". Tapped holes: Class 2 threads.

MACHINE

Bodine Model 42-30 Drilling, Tapping, Assembling Machine.
Write us for Bodine Brochure TE-6 "12 Case Histories."

"You Can't Meet Tomorrow's Competition
With Yesterday's Machine Tools."



18D54

Manhattan Centerless Wheels—More use per dollar

Manhattan Centerless Wheels—More use per dollar

Manhattan Centerless Wheels—More use per dollar

Manhattan Centerless Wheels—More use per dollar

Manhattan Centerless Wheels—More use per dollar



ROUGHING AND FINISHING—WITH THE SAME WHEEL. With Manhattan Rubber Bonded Centerless Wheels fewer passes are necessary to obtain stock removal to required tolerances and desired finish. The same Manhattan Centerless Wheel used for *roughing* can be used for *finishing* by controlling the feed rate and amount of stock removed. This is the advantage of the higher grit-carrying capacity of Manhattan's rubber bond, and its unique ability to produce good finishes even with coarse grain particles. The greater strength of Manhattan Rubber Bonded Centerless Wheels also permits *high speed* grinding (8500 sfpm). You get more production at lower cost . . . **MORE USE PER DOLLAR** from Manhattan Rubber Bonded Centerless Wheels . . . Manhattan Regulating Wheels are supplied either plain or core mounted. Manhattan Core Mountings also result in substantial production savings. Get the details in Bulletin 6925.



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MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Fiat Belts



V-Belts



Conveyor Belts



Hose



Roll Covering



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Abrasive Wheels

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

Buhr

SPECIAL...

Drills, reams and chamfers 565 Connecting
Rods an hour



This Two-Column Automatic Drilling Machine is arranged with tool-steel, laminated, hardened and ground ways.

Heavy-duty ball-bearing construction provided for all spindles.

The eight-station holding fixture is mounted on 60"-diameter automatic Index Table.

Parts are manually loaded, hydraulically clamped and automatically ejected.

All installations comply with J.I.C. Standards.

Automatic lubrication throughout Machine.

Special safety features . . . Only one operator required.

BUHR MACHINE TOOL CO.

ANN ARBOR, MICHIGAN



Buhr

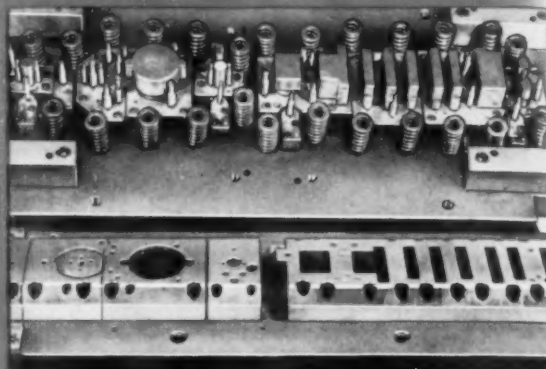
MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY

WHO USES R-B PUNCHES

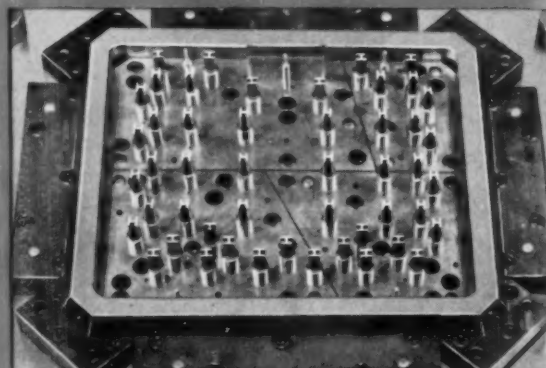


Through many years of providing America's leading industries with interchangeable and standardized punches, die buttons and retainers, R-B has built a reputation for increasing production, lowering costs and saving time. R-B case histories of savings and benefits include users of cam actuated, multi-station progressive, forming, blanking, piercing, embossing and combination dies of all sizes and types.

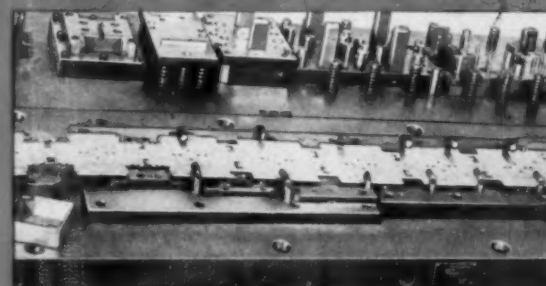
Why don't you investigate the cost saving features of R-B equipment?



PIERCE DIE



DRAW and PIERCE DIE



PROGRESSIVE DIE

Use R-B Engineering Service for Your Tough Piercing Problems.

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
 DEPT. 77 • 12667 BURT RD. • DETROIT 23, MICHIGAN

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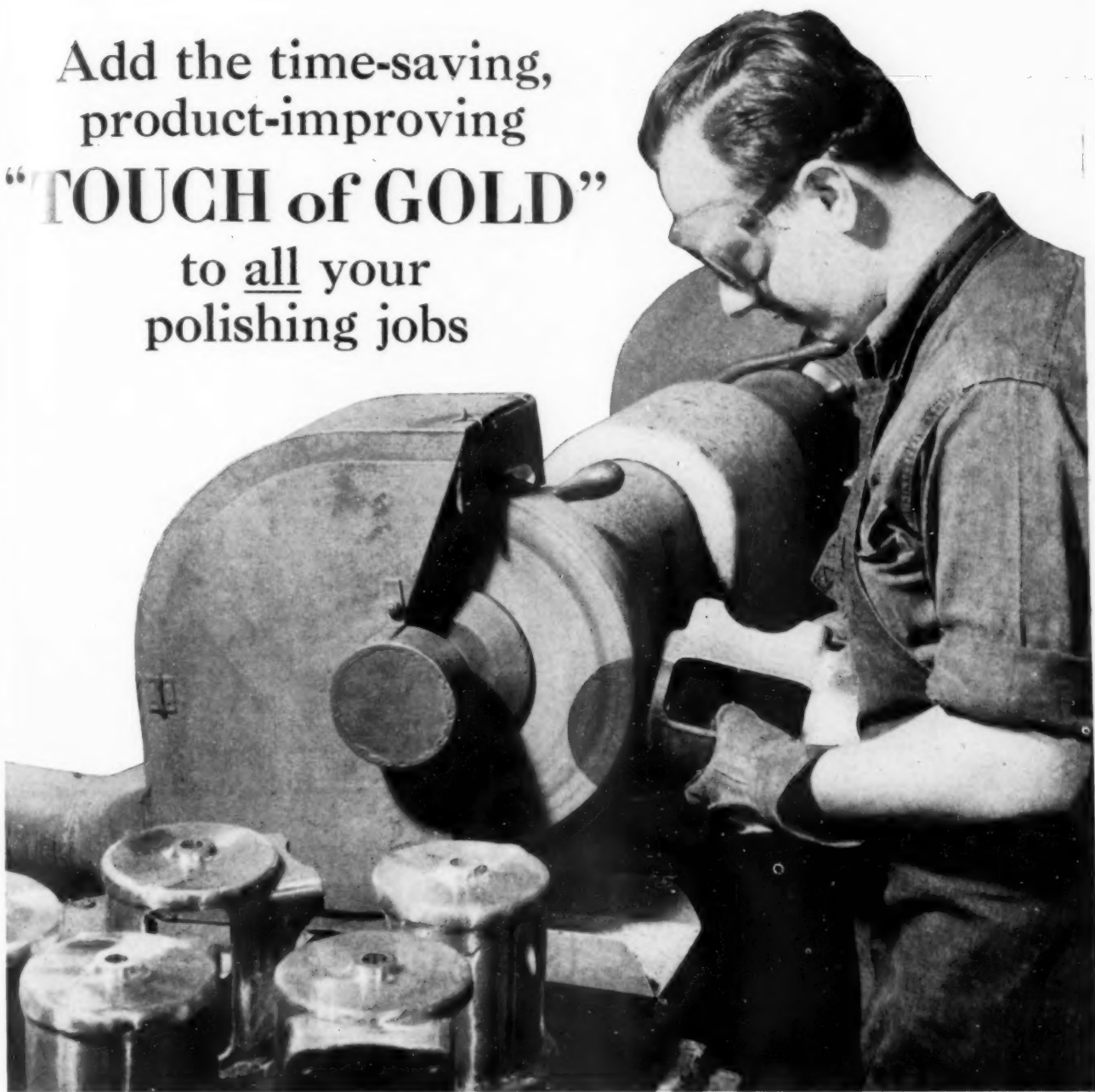
PRECISION GROUND PARTS

SHEET METAL DIES

MADE OF FERROUS ALLOYS,

ZINC ALLOYS OR PLASTICS

Add the time-saving,
product-improving
"TOUCH of GOLD"
to all your
polishing jobs



Marine Equipment Parts get the value-adding "Touch of Gold" when polished with Norton ALUNDUM* abrasive

When you standardize on Norton ALUNDUM abrasive, every polishing job you do gets off to a better start — and finish!

One reason is because the grains in this Norton-developed abrasive are thoroughly uniform in size, structure and chemical composition. Which means thoroughly uniform polishing, with no oversized grains to mar surfaces, and no flats, slivers or undersized grains to loaf on the job. And you get *fast* polishing, too, because ALUNDUM abrasive is famous for rapid, clean-cutting action.

Another reason is that ALUNDUM is specially processed to give it high capillar-

ity. With *all* grains soaking up cement or glue uniformly and adequately, *each* grain is held firmly — assuring long-lasting, top-performing polishing wheels.

**These Advantages
In YOUR Polishing**

mean better-finished, better-looking products in less time and for less money — the sure "Touch of Gold" you can add to all your set-ups, manual or automatic.

Your Norton Distributor

can supply you promptly with ALUNDUM polishing abrasive in the types, sizes and surface treatments you need. Or write to

NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed in your phone directory yellow pages under "Grinding Wheels." *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. G-270



*Making better products...
to make other products better*

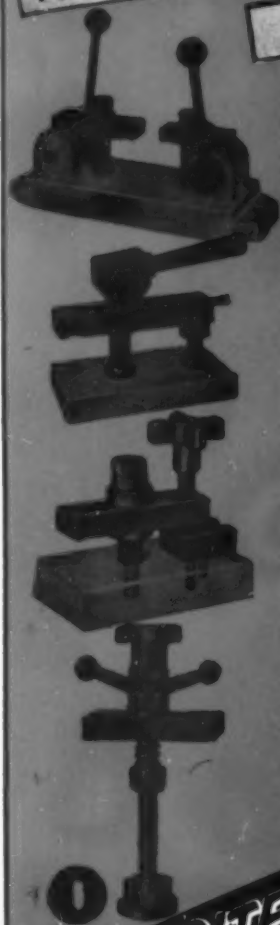
*Trade - Mark Reg. U. S. Pat. Off. and Foreign Countries

CUT DOWN ON TOOL & DESIGN COSTS

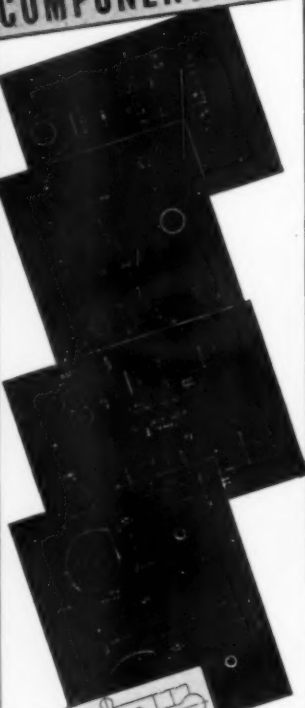
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FIXTURE CLAMPS and

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CATALOG COMPLETE WITH FULL SIZE TRACING TEMPLATES



WRITE TODAY

NATIONALLY USED AS STANDARDS

Recognized throughout the Industry for the development and manufacture of the most economical and highest quality Fixture Clamps and Standard Details. All precision made of heat treated selected steel, cadmium plated and in a wide range of sizes and types to fit the most rigid and exacting requirements. . . . Complete Clamp Assemblies or any of their Component Parts.

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DETROIT 20, MICH

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PROCESSING of CARBIDES

to special shapes and SIZES

made exactly to suit you

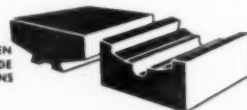
TUNGSTEN CARBIDE HEADING PUNCH



"NEW PROCESS" DIE of actual engraved numbers in carbide



TUNGSTEN CARBIDE DIE SECTIONS



Long life heading dies, form cutters, draw dies, die sections and punches, powder mold and wear parts of solid tungsten carbides or tipped, made to your precise requirements by men and machines. — PIONEERS in CARBIDES. Write for new catalog.

QUALITY



B-M-S CARBIDE SPECIALTIES, INC.

TOOLS 1008 NORTH MAIN ST., BOONTON, N. J. • PHONE BOONTON 8-0071

"PRECISION IN CARBIDES AND STEELS SINCE 1935"

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IF

you bend thin-walled tubing

THEN

you can prevent wrinkling and make perfect bends to smallest radius, by the Cerrobend Method. Save time and money by filling tubes with Cerrobend, the expanding metal that melts in hot water. Then bend the tubes like solid rods. After bending, melt out the Cerrobend in hot water. It can be reused indefinitely.

Write for Data Sheet H3.

CERRO DE PASCO CORPORATION



Dept. 3, 40 Wall St., New York 5, N. Y.

USE READER SERVICE CARD; INDICATE A-6-222-3



SIMONDS **Flat Ground** DIE STEEL

...OIL or AIR Hardening

Ready for 1001 uses, Simonds "Red Streak" Die Steel offers you a choice of either OIL or AIR Hardening. Made from Simonds own steel, it's precision ground to a thickness limit of plus or minus .001", and has an extra smooth surface finish of 25 to 35 micro inches. Edges and ends are square and parallel, with all scale, decarburization and surface defects removed. All sizes come individually packaged with heat treating instructions.

SIMONDS OIL HARDENING DIE STEEL

(non-deforming Molybdenum Type) is uniformly annealed for easy machining and uniform hardening. Due to its wide hardening range (1450 to 1540) good results are assured with even the simplest heat treating equipment. Stock sizes are available from $\frac{1}{4}$ " to 3" thick and $\frac{1}{8}$ " to 14" wide in 18" lengths. The heavier sizes also come in 36" lengths.

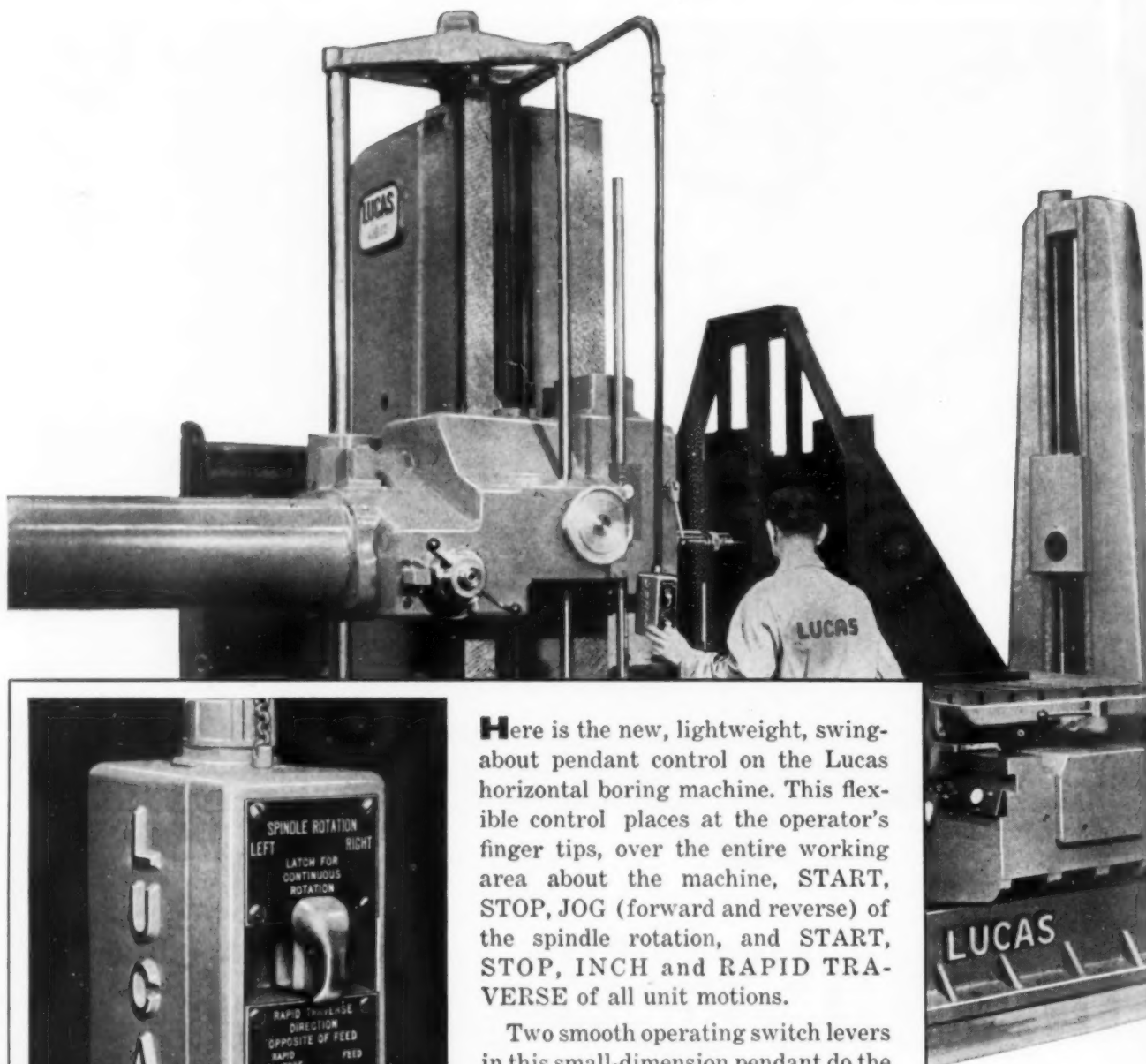
SIMONDS AIR HARDENING DIE STEEL

(non-deforming 5% Chrome Type) is spheroidize annealed for good machinability and uniform hardenability. Its wide hardening range (1700 to 1800 F) makes it practically foolproof in heat treating. Stock sizes run from $\frac{1}{4}$ " to 2" thick and 2" to 10" wide in 36" lengths.

Your Simonds Distributor carries many sizes in stock — can promptly obtain any desired size. Try some on your next job.



Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
 Canadian Factory in Montreal, Que.
 Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
 Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada



Here is the new, lightweight, swing-about pendant control on the Lucas horizontal boring machine. This flexible control places at the operator's finger tips, over the entire working area about the machine, START, STOP, JOG (forward and reverse) of the spindle rotation, and START, STOP, INCH and RAPID TRAVERSE of all unit motions.

Two smooth operating switch levers in this small-dimension pendant do the work of ten control buttons. The position of the levers gives quick visual indication of engagement and direction. One of many features that is keeping Lucas out in front among horizontal boring, drilling and milling machines.

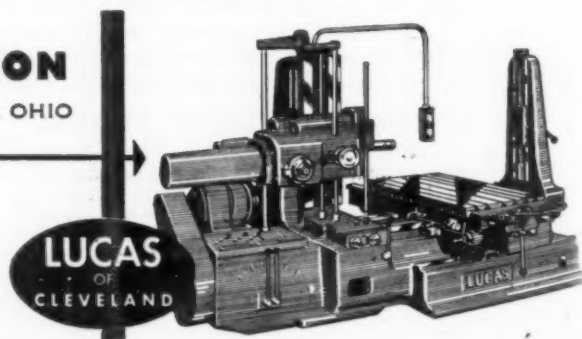
THE LUCAS MACHINE DIVISION

THE NEW BRITAIN MACHINE COMPANY • CLEVELAND 8, OHIO

. . . Machines for Making Progress

Lucas Horizontal Boring, Drilling and Milling Machines

Our general catalog is filed in the Sweet's Machine Tool Catalog File.

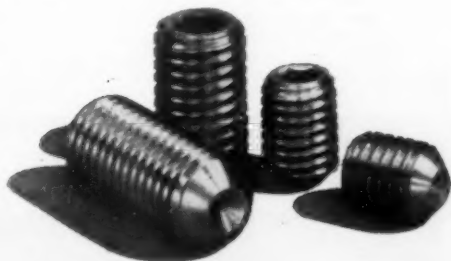




NEW
Allenpoint Set Screws
WITH SCIENTIFICALLY-DESIGNED SMALLER CUP POINTS

Smooth, deep point penetration for greater holding power and resistance to vibration; precision formed threads and accurate thread lead for maximum locking action. Comparative tests by leading laboratory prove Allen Set Screws unmatched in performance. Write to Advertising Department for Bulletin C-33A.

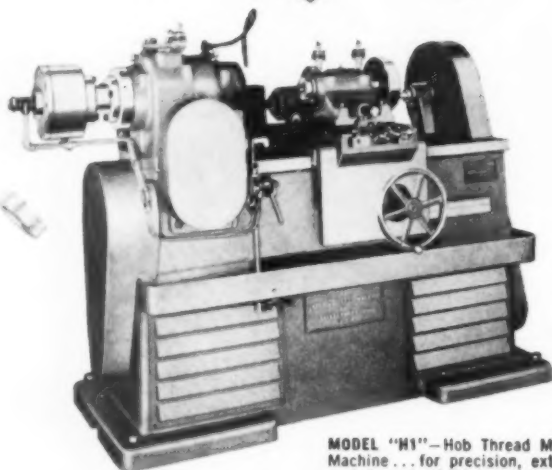
When ordering through your local industrial distributor,
Specify Genuine Allenpoint Set Screws.



ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut U.S.A.



mass-produced with
uninterrupted
accuracy



MODEL "H1"—Hob Thread Milling Machine... for precision, external or internal, right hand and left hand threads... **AUTOMATICALLY!**

when threaded on

COULTER

AUTOMATIC THREADING MACHINES

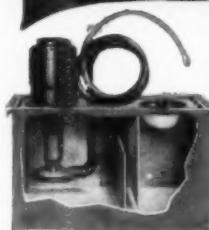
Speed up your production with one of the 3 **COULTER Automatic Threading Machines** for faster, better, and lower production cost parts. Insure yourself with the greatest margin of profits, yet produce parts with uncanny precision, perfect threading and have wide range versatility. Now you can be far ahead of all your delivery schedules. You can thread parts to desired lengths and diameters, use the metals your specifications require, and get a quality product on **COULTER'S** amazing threading machines. Everything is automatic.

Without obligation, consult our engineering staff with your specific threading problems. Catalog and machine specifications available upon request.

MACHINE TOOL BUILDERS SINCE 1896
The James Coulter Machine Co.
645 Railroad Ave. Bridgeport 5, Conn.
USE READER SERVICE CARD; INDICATE A-6-226-1

See how **GRAYMILLS**
Coolant Pumps can
help you

• convert to wet cutting
or
• replace worn out pumps



All-purpose Centrifugal Pump Unit No. H-2-3308A for 90% of machine tool applications



Gear Pump Unit No. 5G1-4-25A Ideal for single spindle drill presses and small lathes

in a matter of minutes for increased production—improved quality — and longer tool life with your present machine tools.

If you need a larger volume of coolant, cutting oils, water, solvents, etc., at low pressures, the new improved Graymills Centrifugal coolant pumps are your answer. If you need higher pressures, for heavier liquids, a Graymills Gear type pumping unit will deliver from 1 to 3 GPM with pressures up to 100 PSI. Both types will give longer trouble-free service, efficient operation at a minimum of cost. Standard models in 1/25, 1/4, 1/2 and 1/2 H.P. Various tank sizes and fittings.

All standard models stocked by leading Industrial Supply Distributors for immediate delivery — or write for catalog.



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PRECISION CIRCULAR CUTTERS



MEYCO carbide tipped and solid carbide cutters have earned an enviable reputation in plants where long tool life and precision workmanship is a **MUST**.

These cutters can be furnished in various diameters and thicknesses to meet the requirements of individual applications.

Saws and cutters, both carbide tipped and solid carbide, will aid production and precision in your slotting, venting, slitting and grooving operations... and they will be manufactured to your specifications. Please furnish complete specs and quantities desired when requesting prices and indicate material to be cut. **MEYCO** experience in the manufacture of precision tools, since 1888, is at your disposal.



W. F. MEYERS CO., INC., BEDFORD, INDIANA

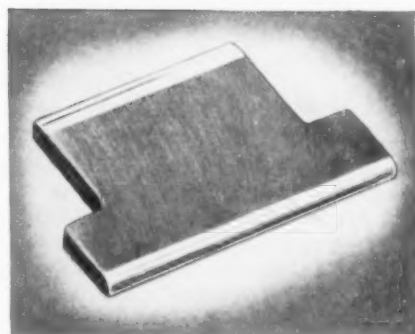
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The Tool Engineer

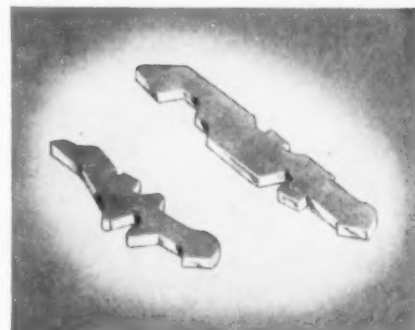
Why wait? CUT YOUR COSTS NOW!

let the
leading
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of broaching
equipment
show you
how to
lower your
break-even
costs.

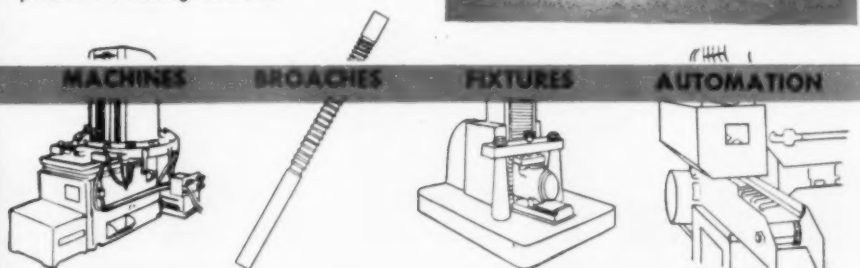
TEN TIMES FASTER than previous methods—broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.



THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.



TWENTY TIMES FASTER than other methods—the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.



why HANNIFIN series "N" cylinders are the recognized standard of the hydraulic industry

THE MOST COMPLETE STANDARD LINE

Hannifin is your single source for the broadest standard line of hydraulic cylinders on the market. When you need hydraulic cylinders, you'll save time and money by selecting from the complete Hannifin line.

- 12 bore sizes, 1" to 8"
- 11 standard mountings—more than 65 combination mountings
- No tie rods; ideal for long-stroke applications
- Cushioned and non-cushioned
- Double end piston rods available in most styles
- Bodies of heavy-walled steel tubing "TRU-BORED" and honed



WRITE FOR
BULLETIN 110
Complete
specifications
and
dimensions

DESIGNED AND BUILT FOR SUPERIOR PERFORMANCE LONGER LIFE

No tie rods. Finer appearance, greater strength. This permits unusual length when required.

Alloy iron Universal end caps. Rugged. Port completely rotatable—air vents four sides.

Alloy iron Universal collars. Removable, replaceable. Permit exact positioning of foot-type mountings.

Satin-smooth bore. "TRU-BORED" perfectly straight, perfectly round.

Cast iron piston. Grooves precision cut for superior seal. Piston concentric with and locked to piston rod.

Confined gaskets—seal positively, cannot extrude.

Ground steel piston rod. Concentric with and locked to piston.

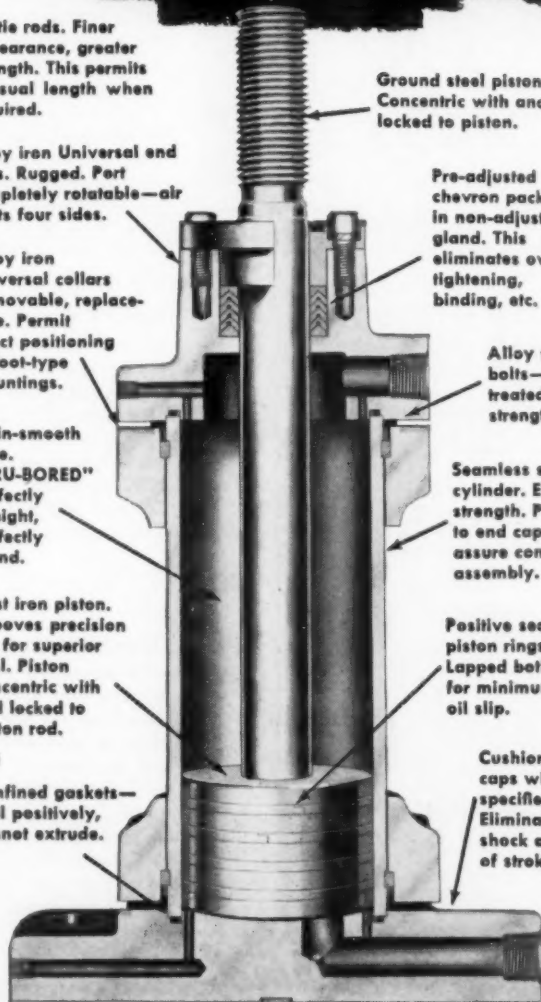
Pre-adjusted chevron packings in non-adjustable gland. This eliminates over-tightening, binding, etc.

Alloy steel bolts—heat treated for strength.

Seamless steel cylinder. Extra strength. Piloted to end caps to assure concentric assembly.

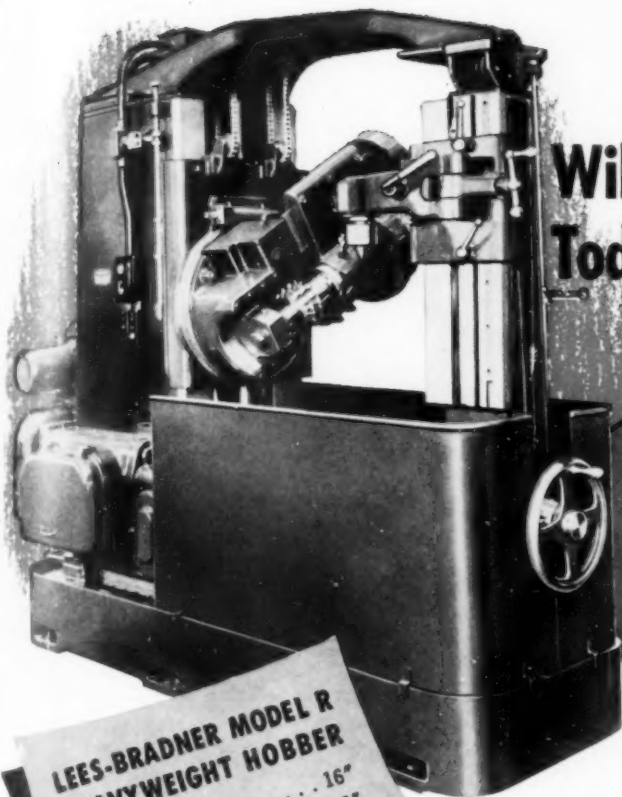
Positive seal piston rings. Lapped both sides for minimum oil slip.

Cushioned caps when specified. Eliminate shock at end of stroke.



HANNIFIN

HANNIFIN CORPORATION • 1119 S. KILBOURN AVE., CHICAGO 24, ILLINOIS
AIR AND HYDRAULIC CYLINDERS • HYDRAULIC POWER UNITS • PNEUMATIC AND HYDRAULIC PRESSES • AIR CONTROL VALVES



Will the Machines You Buy Today Fill Tomorrow's Needs?

LEES-BRADNER MODEL R HEAVYWEIGHT HOBBER

Maximum Outside Dia. 16"
Travel 18"
Maximum Helix . . RH 45° - LH 60°
Machine Weight 13,000 lbs.
Motor Requirements . 15 to 25 HP



How about that machine you're thinking of replacing today? Awhile back it looked pretty good, didn't it? Good enough to fill your needs when you bought it, anyway. But now it can't handle today's job and it must be replaced.

When you buy that new machine—*look ahead*. Don't invest in one that just barely meets today's needs. Think about that extra capacity you'll probably need tomorrow.

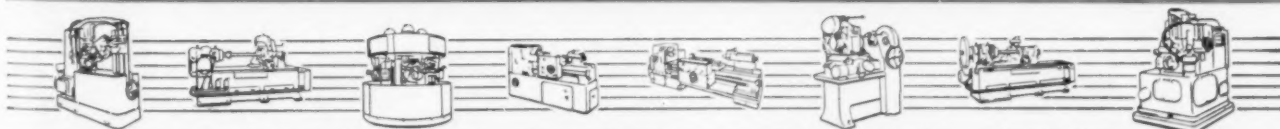
Lees-Bradner manufactures a full line of hobbing machines to meet different requirements. If a smaller capacity machine will do your job today — *and tomorrow* — fine, that's for you.

But if you suspect you'll need higher speeds, faster feeds and greater production capacity in the near future it's wise to gear your thinking and purchasing accordingly.

the LEES-BRADNER

CLEVELAND 11, OHIO, U.S.A.

Company



MODEL R HOBBER MT THREAD MILLER 7-A ROTARY HOPPERS CRI-DAN THREADING MACHINES MODEL 40 THREAD MILLER 5H SPLINE HOBBER 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER



Beaver STANDARD ARBORS
AND ADAPTORS CUT DOWN-TIME
LOSS—ASSURE ACCURACY FOR YOUR
CUTTING TOOLS!



The finest economy in the purchase of arbors and adaptors is quality.

Beaver Standard Tools are made to unusually high standards of quality. No stinting is permitted on workmanship or materials. Beaver Standard Tools are made with the same care and accuracy as precision aircraft parts . . .

hard, and wear resistant, on the surface but with a strong, tough core.

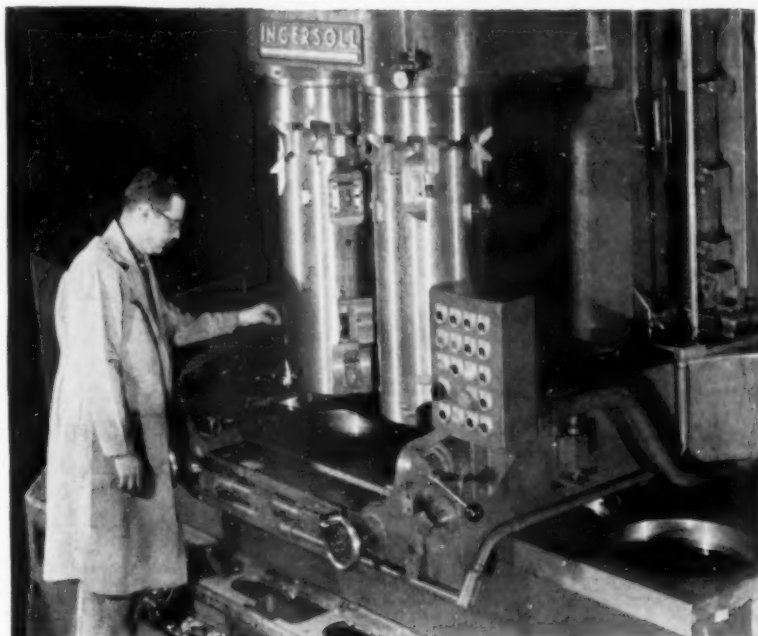
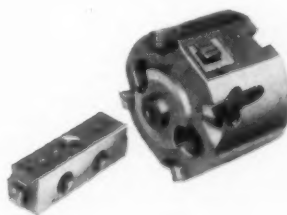
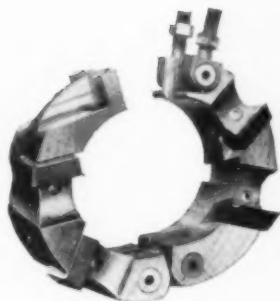
Remember, an extra set of arbors and adaptors is cheap insurance against loss from down-time in case of emergency.

You'll do a better job with less investment with Beaver Standard Tooling—try it, you'll like it too.

Beaver TOOL AND ENGINEERING
CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICHIGAN





INGERSOLL BORING TOOLS SPEED DIESEL CRANKCASE PRODUCTION

These unusual Ingersoll inserted blade boring heads are used on a specially designed Ingersoll machine built for a manufacturer of diesel locomotives.

The range of our experience in machining holes is further illustrated by tools which Ingersoll has developed for high-production work on automobile cylinder blocks and for small-lot production on all types of general-purpose bar-type machines.

Have you investigated opportunities for savings in your work through the use of multiple-point Ingersoll boring tools in place of single-point tools?

WRITE FOR Catalog 60F, describing Ingersoll Inserted Blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters, and boring heads.



THE

INGERSOLL

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF *SHEAR CLEAR* CUTTERS

MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

compare YOUR drill fixture COSTS with ANCHOR BUSHING templates

Anchor Bushing drill templates, using sheet metal or laminate plastic materials, are made flat or in compound curved forms at a fraction of cost and time required for similar conventional drill fixtures.

Your TOOLING COSTS are reduced in simplified design and fabricating methods. Your MATERIAL DOLLARS go further by using inexpensive hardened steel Anchor Bushings and sheet metal or plastic materials. Your PRODUCTION JOB TIME is conserved since lightweight Anchor Bushing templates reduce worker fatigue and storage problems.

Compare your drill tooling methods, as have leading aircraft tooling departments, with the Anchor Bushing Method.

Ask today for our Anchor Bushing Catalog — it describes methods, bushing styles, sizes and prices.

Solar Aircraft Company, San Diego, craftsmen use contoured Anchor Bushing drill template on nacelle of Lockheed P2V Neptune aircraft.



Standard Anchor Bushings for rivet or spot weld attachment to sheet metal or fiberglass.



Nutplate Anchor Bushings provide three coordinated screw and rivet attachment holes in one bushing.



One piece Anchor Bushings for laminate plastic materials. Imbedded into plastic before heat hardening process.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-232-1



ALADDIN COULDN'T HAVE GOTTEN BETTER SERVICE OR RESULTS

From the Graphic proposal to the completed and delivered final assembly, body framing buck took less than 8 weeks. No magic lamp like Aladdin had at his disposal, no genie, not even a genius, accomplished this feat. This was no miracle but routine every-day planning for a fully coordinated design and build service. Full responsibility is an equally important by-product. No alibis, no useless extra charges, the Berg Organization, responsible for design and build, is the painless way to better tooling.

Berg

THE COMPLETE ENGINEERING SERVICE
18050 RYAN ROAD
DETROIT 34, MICHIGAN
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Severance CHATTERLESS TOOLS

HIGH SPEED CARBIDE

Winning their way on job after job, they are carefully designed to preclude chatter and can be depended on to produce superior finishes.



Severance CHATTERLESS COUNTERSINKS

STANDARD TYPE — Stocked in 13 diameters up to 2" and in 30°, 41°, 45°, and 60° angles (with C/L).
Sizes 1" and larger stocked also threaded for shanks — tapered or straight — in various sizes.
Use CARBIDE for tough jobs or high production.

HEAVY DUTY TYPE — Features larger shanks having a long drive.



Full range of sizes and angles.

HEADQUARTERS FOR COUNTERSINKS, REAMERS, SEATING TOOLS, and SPOTFACERS that preclude chatter.

Severance CHATTERLESS BALL SEAT REAMERS



Standard and Heavy Duty Types 8 sizes each. Made also for shaped cavities — as ordered.

BALL NOSE DRILLS — In corresponding sizes hog out the stock for Ball Seat Reamers.



Severance TAPER REAMERS



• Faster cutting
• Better finishing
• Shear-cut teeth

Tapers up to 15° quickly supplied from stock — up to 1 1/4" diameter x 2 1/4" long.

Unexcelled for holes having keyways, ports, splines, cross holes, etc.

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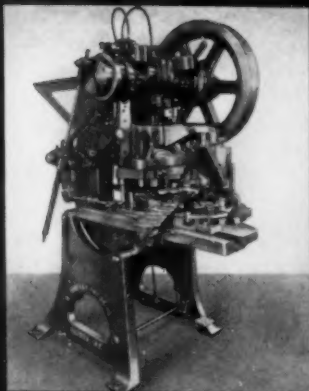
SEVERANCE TOOL INDUSTRIES INC.
728 Iowa Street • Saginaw, Mich.

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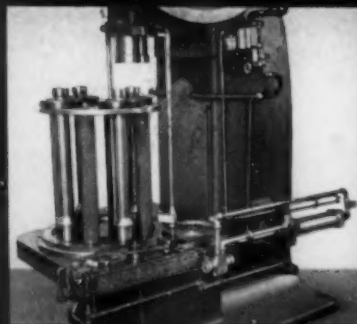
MIDGET MILL GROUP



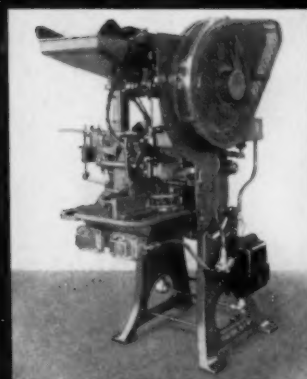
The Tool Engineer



V & O has the sturdiness that makes automation practical.



V & O can provide the working height that automation may need.



V & O has the precision that is fundamental to automation.

If made on a standardized assembly line, the mere changing of a few bolt sizes can cause a press to become a "special job." But if made in the V & O shop the most extraordinary of press automation features are just part of the day's work.

V & O was started, 65 years ago, to eliminate the problems of automated press tooling. Our long slide principle, the greatest boon to press automation, was built into the first press we ever made. We have lived with automation, worked with automation, dreamed out the answers to automation problems, for all those years. And there is no such thing as an automated press that does not have special features.

When you have a production problem that can be solved by automated tooling, automated feeds, higher

HOW SPECIAL IS A

precision tool motions, or tools whose lives depend upon the precision with which the press operates, take it up with V & O.

When you want the press that will be easiest for your own tool makers to automate, be sure that you get a V & O.

Our representative would like to tell you more about the press that is built like a high grade machine tool. Write us, please.

"SPECIAL"

MACHINE?



THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

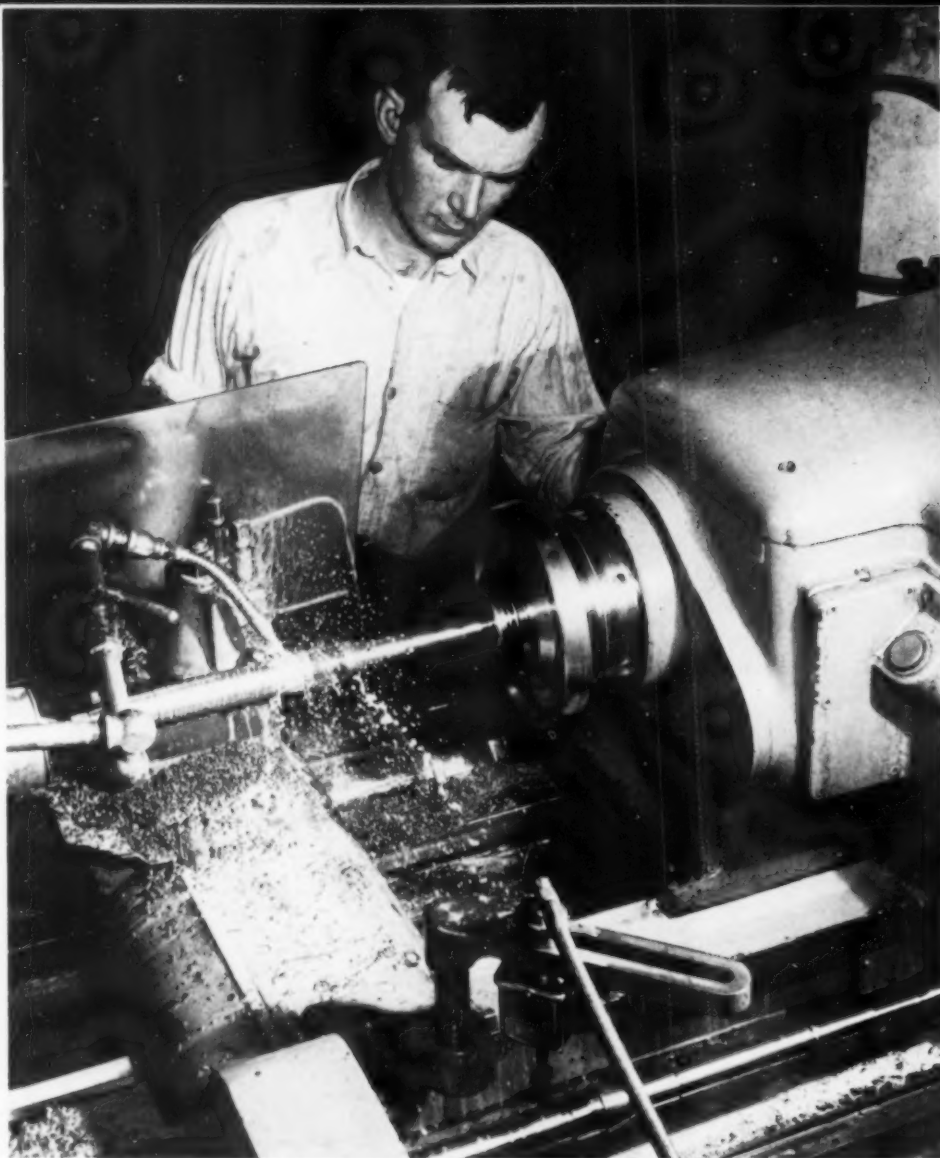
BUILDERS OF PRECISION POWER
PRESSES AND FEEDS SINCE 1889



**WHY THE V & O LONG SLIDE
PROVIDES BETTER ALIGNMENT**

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.





TRACER LATHE TURNS ARMATURE SHAFT AS JACOBS COLLET CHUCK HOLDS WORK RIGID.

COLLET PERFORMS GRIPPING FEAT

Rubber-Flex Collet jaws close down on work with parallel bearing that defies slippage

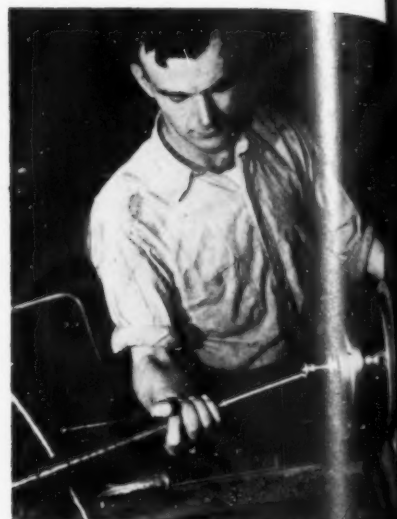
International Equipment Company in Brighton, Massachusetts has high praise for a unique collet it uses. The collet daily delivers the tightest, most accurate grip ever devised in lathe collet equipment — 2 to 4 times the gripping power of split steel collets.

This Jacobs Rubber-Flex Collet, the heart of the Jacobs Spindle Nose Lathe Collet Chuck, provides an absolutely parallel grip over the entire bearing surface. Its multiple, long steel jaws are locked together with oil resistant synthetic rubber and offer a length of bearing that is 50-75% greater than can be obtained in split steel collets.

The full $\frac{1}{8}$ " range of the collet permits chucking bars with variable outside diameters.

"Eleven of these collets have the gripping range of eighty-eight split steel collets," points out Evan Anderson, Assistant Foreman, Maintenance Division.

The collet's radically different construction is considered, by tool engineers, one of the most outstanding developments in modern tool history. Jacobs Spindle Nose Lathe Chucks, known all over the world, are stocked and sold by your Industrial Supply Distributor. The Jacobs Manufacturing Company, West Hartford 10, Connecticut.



SHAFT IS INSERTED AT AN ANGLE by Walter B. Best, operator. This is allowed by the flexibility of the collet and greatly reduces tailstock resetting adjustment.



COLLET GETS IMPACT TIGHTENING. Hand-wheel hammer lugs deliver an impact blow on impact sleeve inside handwheel. Force exerted is several times greater than in ordinary hand tightening.

JACOBS SPINDLE NOSE LATHE CHUCK permits use of maximum speeds and feeds on modern tool room lathes. Chucks any bar between $\frac{1}{16}$ " and $1\frac{1}{4}$ ". The world's finest collet chuck.

**IF IT'S A
JACOBS
IT HOLDS**

**Jacobs and your
local distributor**

are ready to deliver the chucks you need and the service you deserve.

**... first in chucks
... first in service**

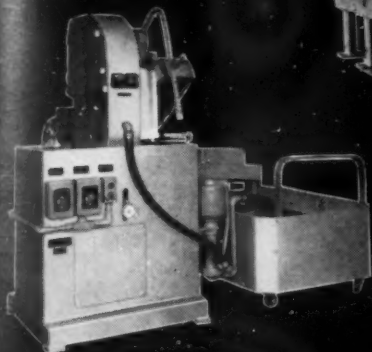
ACCO
Products

Campbell Abrasive Cutters

Rotary Abrasive Cutters

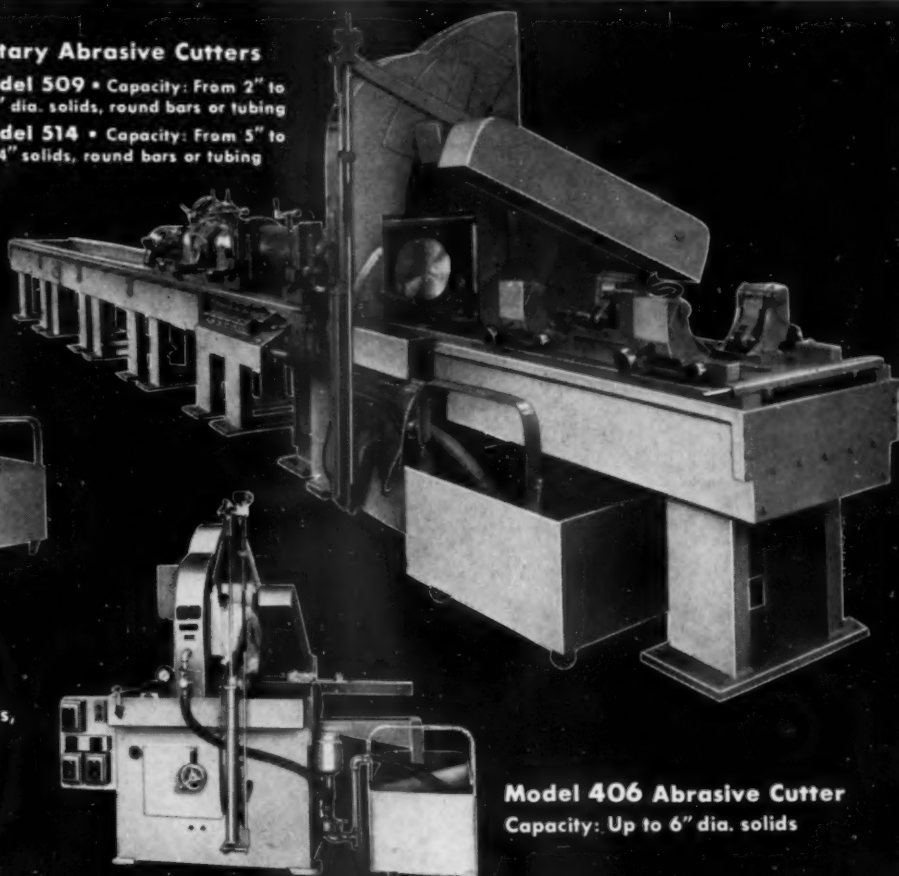
Model 509 • Capacity: From 2" to 9" dia. solids, round bars or tubing

Model 514 • Capacity: From 5" to 14" solids, round bars or tubing



**Model 223
Abrasive Cutter**

Capacity: Up to 2" dia. solids,
4" dia. tubing



Model 406 Abrasive Cutter
Capacity: Up to 6" dia. solids

Quick cut-offs save you money—here's how . . .

By rapidly cutting stock that takes much longer by other cutting methods, CAMPBELL Abrasive Cutters reduce your labor costs and the number of machines required. They make quality cuts on alloy and high carbon steels. Close tolerances, smooth finish and straight cuts can be made, resulting in large savings of material. Cuts all types of stock without hardening and with minimum of burr.

It will pay you to remember these CAMPBELL features:

1. Superior Sales Engineering Service

CAMPBELL engineers, experienced in every type of cutting problem, are available for consultation on YOUR cutting problems.

2. Economy and Speed of Operation

CAMPBELL Abrasive Cutters are built to do every type of cutting job with the utmost accuracy, efficiency and economy. Cuts are smooth and practically burr free.

3. Complete Line of Standard Machines

CAMPBELL Abrasive Cutters are available in the widest variety of styles and models. They are fully automatic and semi-automatic. Have many exclusive features. . . .

Consultation with trained CAMPBELL engineers will cost you nothing. Let them show you how the addition, or substitution, of the right abrasive cutter can increase your output per man-hour. It could be the most profitable move you ever made.

Write today for Bulletin DH-301 on Campbell Abrasive Cutting Method

ACCO



Campbell Machine Division
AMERICAN CHAIN & CABLE

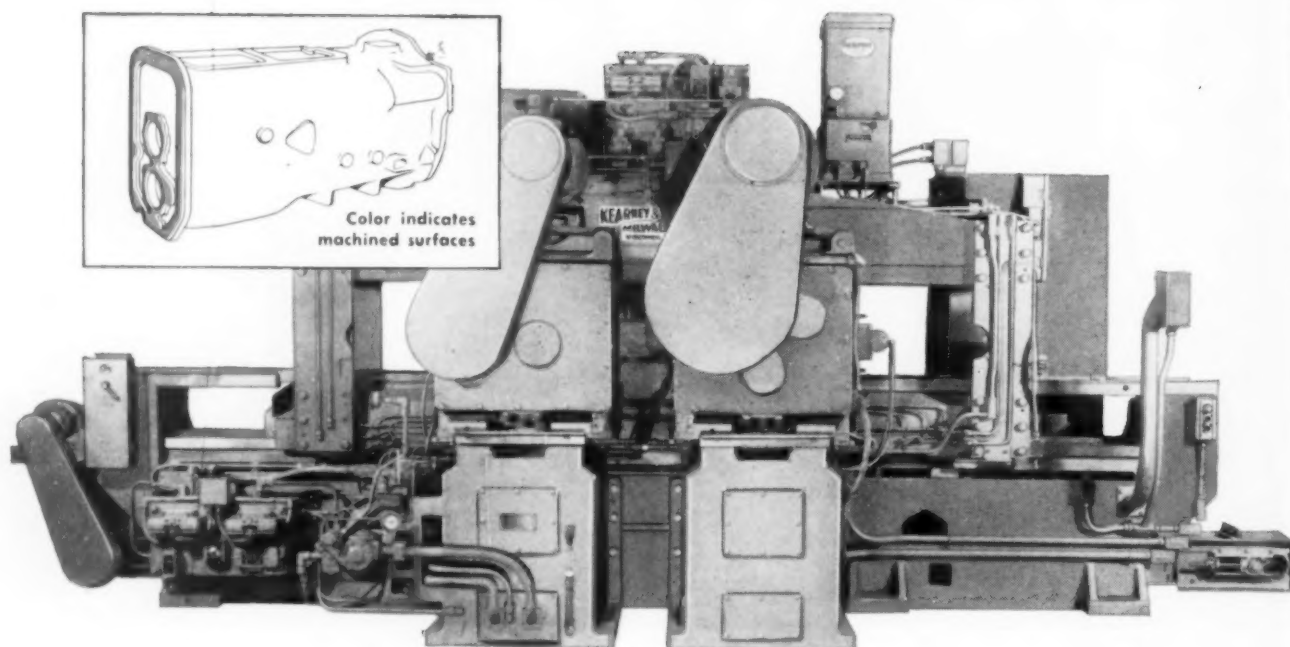
945 Connecticut Avenue, Bridgeport 2, Connecticut

**Wet and Dry
Cutters and
Nibblers**

What a saving...



Builders of Precision and Production Machine Tools since 1898



Color indicates machined surfaces

For the customer... it combined four milling operations in one machine!

THIS special 6-spindle transfer type milling machine was designed and built to keep a tractor manufacturer's production line rolling at high speed. The machine now mills opposing end faces of tractor transmission cases both flat and parallel... to close tolerances (.002)... in only 94 seconds.

FOUR HYDRAULICALLY RETRACTING HEADS... First two heads have two spindles each for roughing.

Second two heads have one spindle each for finishing. **CLAMPING MECHANISM...** Large hollow workpiece is secured at each machining station by a tunnel-type hydraulic equalizing clamping fixture. This eliminates the distortion usually encountered when clamping this type of workpiece.

If you have problems that require special machinery—contact your Kearney & Trecker representative.

Capacity... Experience... Performance

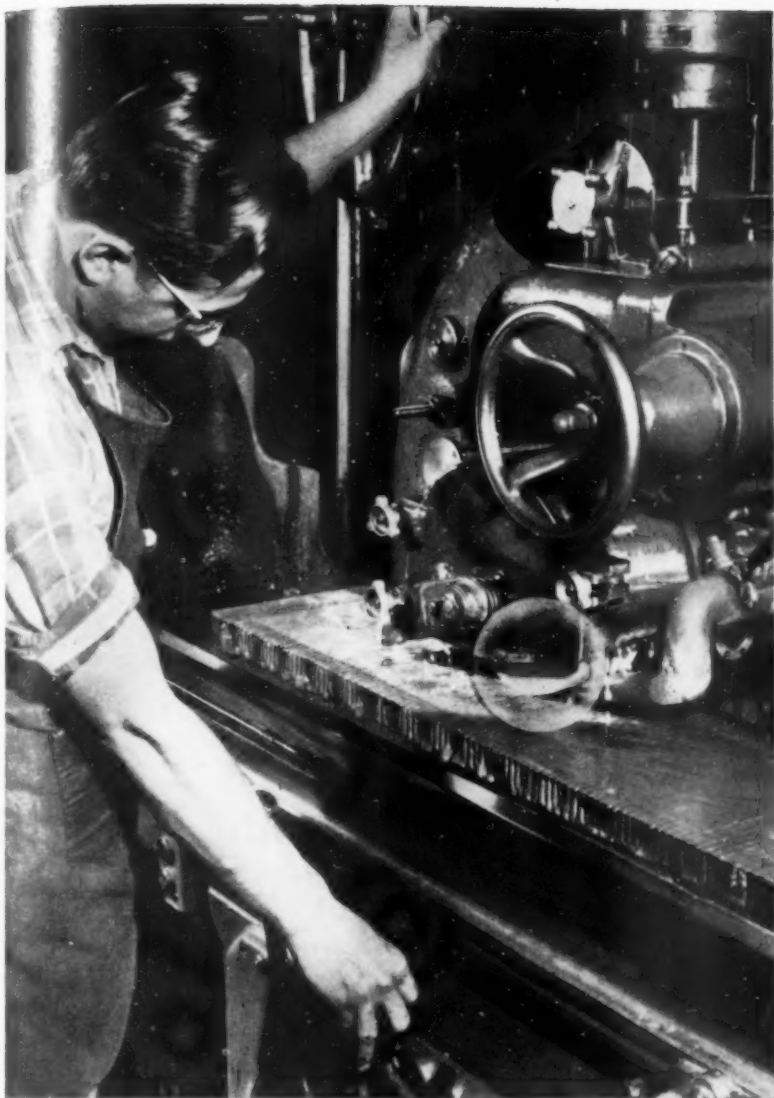
Upon completion of this \$5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.



For more details on this machine...

ask for **Data Sheet No. 1002**. Free booklet, "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking. Write today to **SPECIAL MACHINERY DIVISION, KEARNEY & TRECKER CORP.**, 6784 West National Ave., Milwaukee 14, Wisconsin.

KEARNEY & TRECKER CORP. · Special Machinery Division
MILWAUKEE 14, WIS., U.S.A.



"The new G Bond ALUNDUM wheels give us double the production of former standard wheels." That's how a Massachusetts manufacturer sums up the performance of the new Norton wheels in grinding hardened high-speed steel textile blades. He adds: "Wheels used on this job must be very free and cool cutting to avoid warping and burning the very thin stock."*



"I get a fast cut and good finish. They're the best and most versatile segments I ever used for this kind of work and I'm re-ordering ten sets," reports an Illinois customer using G Bond segments for surface grinding mild steel, cast iron and Meehanite — all three.

NORTON
ABRASIVES

Making better products... to make other products better

These users say:

**For surface
grinding,
the new
G BOND
beats them all!**

*Latest Norton wheels bring
you the money-saving
"TOUCH of GOLD"*

Naturally, we've kept close watch on how the new G Bond wheels are doing. And we can report that throughout the range of precision and semi-precision grinding applications they're already away out in front. In the field of surface grinding, for instance, a composite statement by users of the new G Bond would run very much like this:

"G Bond wheels cut freer, cooler, faster — enabling us to take heavier cuts in costly high speed steels without drawing temper. They give us closer tolerances and smoother finishes. They dress easier and produce more pieces per dressing. Doing more work and a greater variety of work — per wheel, they outlast any wheels we ever used before."

G Bond Wheels for YOUR Surface Grinding

will bring new speed and economy to surface grinding jobs — thanks to their unique grain-holding structure that produces greatly improved cutting action. Remember, the G Bond is the most modern, most efficient vitrified bond ever developed — a typical Norton "Touch of Gold" achievement that steps up grinding performance and product quality while cutting grinding costs.

See Your Norton Distributor

for the ALUNDUM G Bond wheels, cylinders and segments you need. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. Export: Norton Behr-Manning Overseas Inc., Worcester 6, Mass.

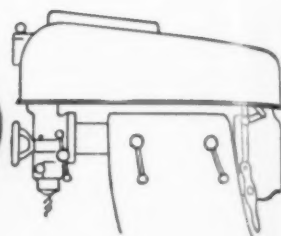
W-1537

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NEWEST OF THE U. S.-BURKE SUPER-VALUE MACHINE TOOLS

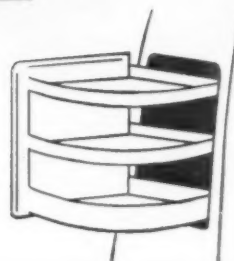
THE ECONOMICAL ANSWER
TO ACCURATE, VERSATILE
VERTICAL and ANGULAR MILLING

"U. S." VERTICAL Milling Machine



Balancing of head and motor and very substantial column provide increased rigidity and accuracy.

Another feature is the built-in spot light which assures maximum visibility at most vital points.



Swing-out shelves handily house tools right in the column of the machine.

Thoroughly tested on the job by many of America's foremost manufacturers.

Created by America's foremost producers of small milling machines, to fill the big need for a balanced-head vertical miller that provides greater capacity and flexibility than is normally associated with machines of its type.

The new U. S. Vertical ideally combines most advanced engineering, experience of practical machinists and modern design without sacrifice of basic characteristic "U. S." simplicity.

COSTS SURPRISINGLY LITTLE

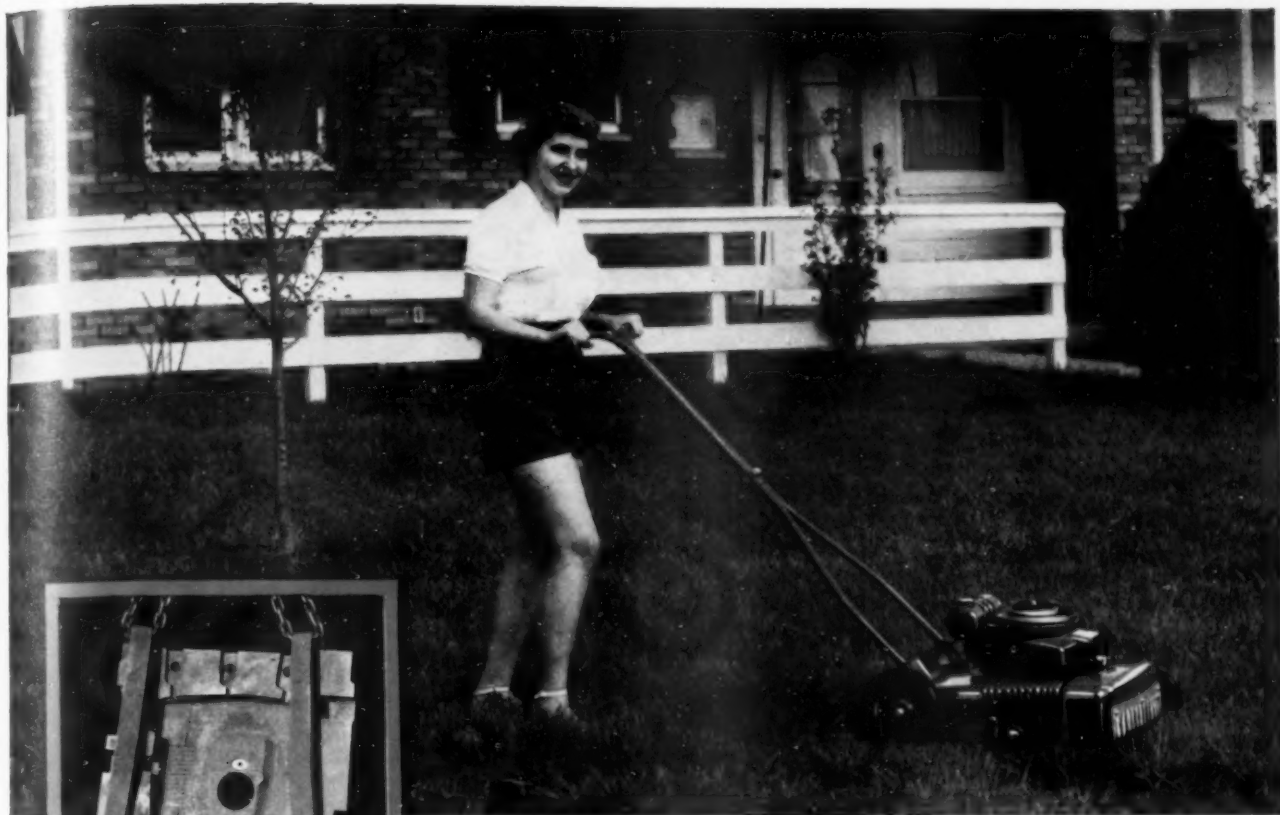
Quickly pays for itself by simplifying or taking over vertical milling and boring jobs which often tie up far more costly standard machines.

SEND FOR COMPLETE DETAILS

Illustrated literature which describes complete specifications, capacities, exclusive features and advantages gladly furnished on request.

U. S. BURKE
MACHINE TOOL DIV.

Brotherton Road 16,
Cincinnati 27, Ohio



HOW LINDBERG STEEL TREATING COMPANY HELPS MOW YOUR LAWN

Plants in

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(Chicago)
1971 North Ruby
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2910 So. Sunol Drive
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Gus Stuart next door . . Tom Dougherty down the street . . and Harry Van Hook in the next town are taking it easy.

For these lazy, lucky critters live in the era of the power lawn mower . . they just give it the gun, and zoom . . a beer-and-a-half later the yard is mowed, slick as a whistle.

We're not about to tell you Lindberg Steel Treating Company is solely responsible for the power lawn mower industry. That isn't exactly the case. But, along with dozens of designers, engineers, and production men, we kicked in our two cents worth.

Quite a few power lawn mowers have cast aluminum shells . . one of them is the "Lawn-Boy" made by Outboard Marine & Manufacturing Company*. "Outboard" needed mold dies to produce these mower shells . . and the dies had to be heat

treated. They were intricate, had plenty of irregular sections, and they were worth \$15,000.

The highly polished surface finish had to be maintained. Critical dimensions had to be held. There could be no carb or decarb, because surface cracking or "orange peeling" would result. Brinell hardness had to be held to a narrow range. And there could be no variation in hardness uniformity.

So the job was turned over to heat treating specialists . . metallurgical engineers of Lindberg Steel Treating Company. They determined the proper cycle for preheating, soaking, cooling, and tempering.

91 short hours after delivery to Lindberg, the dies were ready to produce aluminum mower shells. Heat treating is easy . . if you do the *right* thing, at the *right* time, in the *right* equipment, in the *right* way. We specialize in doing heat treating . . *right*. Call us.

* RPM Manufacturing Company Division

A case history of Lindberg Steel Treating Co. service to American industry

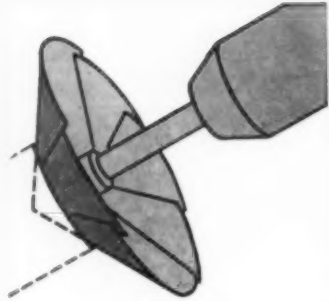


LINDBERG STEEL TREATING CO.

1977 North Ruby Street, Melrose Park (Chicago), Illinois

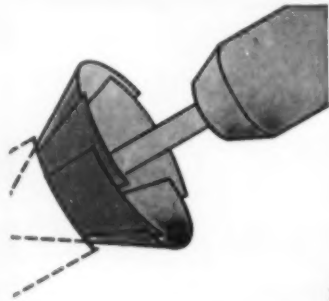
Phone: Fillmore 4-4080

Saved minutes add up...



SLICK TRICK-

for radiusing the edge of a hole. On a portable tool, the "wings" of a METALITE Cloth Slotted Disc are thrown out flat by centrifugal force, but gradually fold in as the disc is pushed into the hole. You can see why it does a neat, quick, uniform job.



when you use these BEHR-MANNING ABRASIVE TOOLS

Take for instance, radiusing or deburring the edge of a hole. See (at left) how beautifully simple it is with a METALITE® Cloth Slotted Disc. You get the same time-saving result on any number of tricky jobs, with the many specially designed BEHR-MANNING® abrasive tools. They enable you to quickly finish all kinds of edges, contours, recesses, inside surfaces. Look over your operations and replace slow, clumsy hand methods with time-saving abrasive tools. The booklet, "Blueprints for Production," will help you. Write Behr-Manning Corp., Troy, N. Y., for your copy. Address Dept. TE-6.

In Canada: Behr-Manning (Canada) Ltd., Brantford.
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New Rochelle, N. Y., U.S.A.

G-1



BEHR-MANNING

CORPORATION

division of NORTON Company

- ▲ COATED ABRASIVES
- ▲ SHARPENING STONES
- ▲ PRESSURE-SENSITIVE TAPES



ACCURACY—Accuracy of the gear is directly related to the accuracy of the hob that generates the teeth of the gear. A Michigan Tool inspector is shown here checking and charting the accuracy of a large two-thread Michigan Process hob on the Michigan Sine-Line model 874 hob lead checker.



This Month's **GEAR PIX**

15 SHEAR-SPEEDS—Four of a battery of fifteen Michigan Shear-Speed gear shapers which cut a variety of slots or serrations on malleable planetary elements in a large automotive automatic transmission plant. All slots or serrations are cut simultaneously, in some cases two parts at a time, by the Shear-Speed gear shapers.

NEW 3-WAY GEAR SELECTOR automatically segregates 100% of gear production into undersize, oversize and OK gears as fast as they are cut or finished. Made in both gravity and conveyor types. May be attached to any gear cutting or gear finishing machine. Can be integrated with the machine cycle to automatically shut off the machine whenever a certain percentage of undersize or oversize gears are produced.



MICHIGAN TOOL COMPANY

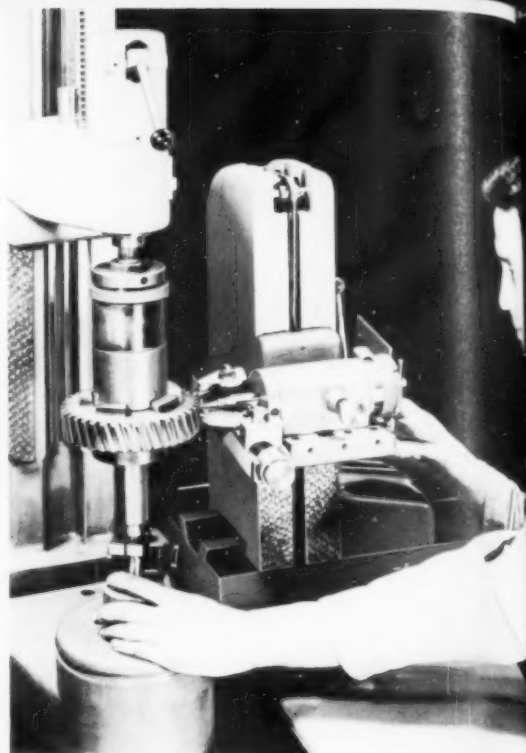
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD

Over

This Month's GEAR PIX



GEAR INSPECTION—One of the rows of Michigan model 1129 gear speeders used to inspect gears in a large automotive automatic transmission plant, prior to assembly. Gears are speeded in mesh under brake loads to check quietness and tooth contact.

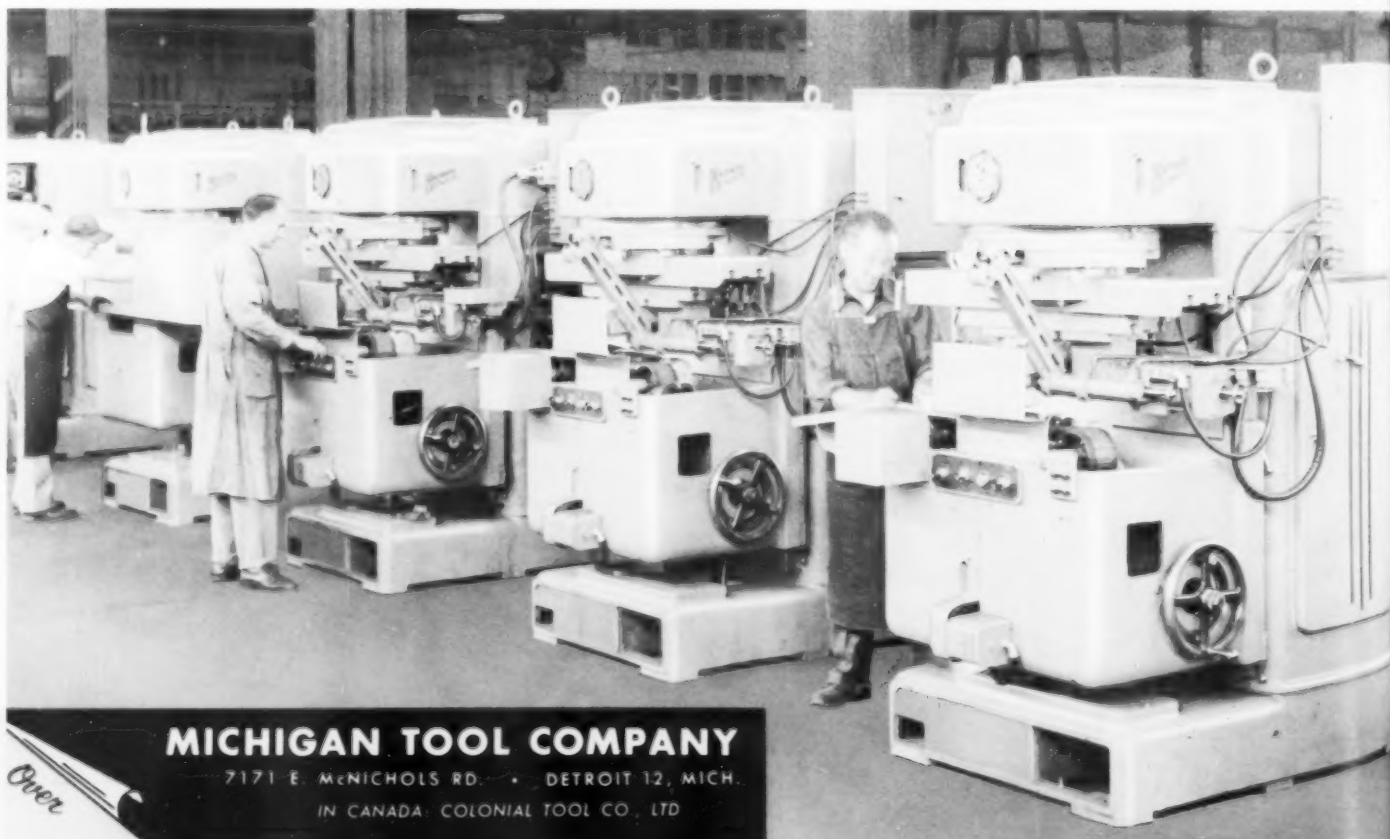


INVOLUTE AND TOOTH SPACING

—One of the leading lathe manufacturers uses this Michigan Sine-Line model 1124 involute and tooth spacing checker to inspect the involute contours and tooth spacing on the helical and spur gears that are used in their line of lathes.

AUTOMATIC LOADING & SIZING

More than four out of five of the standard Michigan 870 gear shavers now being built are equipped with automatic chute loading and automatic size checking. This speeds up the shaving cycle and permits one operator to handle up to three of these machines with ease.



MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD

Over

'TOOL LIFE UP 400%

PRODUCTION UP 50%

WITH GULF CUT-AID[®]



Mr. Tedford and a Gulf Sales Engineer check an aluminum fitting produced by one of the Warner & Swasey Automatic Screw Machines in the Eastman shop. The cutting fluid used is Gulf Cut-Aid. Eastman makes copper tube fittings, hydraulic hose couplings, and auxiliary equipment for air conditioners.

says Mr. C. E. Tedford,
vice president and plant manager of
the Eastman Products Corporation,
Plano, Texas.



A cutting fluid has to be outstanding to increase tool life 400% and production 50%—and that's what Gulf Cut-Aid has accomplished at Eastman Products! You too will discover that Gulf Cut-Aid, when used for machining aluminum, magnesium, and many other nonferrous metals, consistently produces better results—that means lower costs for you.

Here are some of the advantages of Gulf Cut-Aid that make such results possible: high rate of penetration, "wettability," and excellent cooling properties. It quickly covers tool surfaces to provide constant protection. It also contains an effective anti-oxidation additive which helps prevent gum and sludge formation in the coolant

system. And it will not corrode or stain metals.

Let a Gulf Sales Engineer assist you in finding opportunities for improved machining practice in your plant through the use of Gulf Cut-Aid. Contact him at your nearest Gulf office today.

Gulf Oil Corporation • Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA



Make SET-UPS THIS EASY WAY!



You'll have no more worries over the accuracy of your set-ups for tapping and reaming jobs if you make them with a Ziegler Floating Tool Holder. It's the easiest way of making set-ups—and also the most accurate way. Instead of taking the extra time required to make a set-up of absolute accuracy, you can quickly align the work to within 1/32" tolerance and leave it to the Ziegler Tool Holder to do the rest.

In leading industries throughout the nation, the Ziegler Holder has proven itself an economy far out of proportion to its small cost. Get one for your next tapping or reaming job.

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

Ziegler
ROLLER DRIVE
FLOATING HOLDER
for Taps and Reamers...

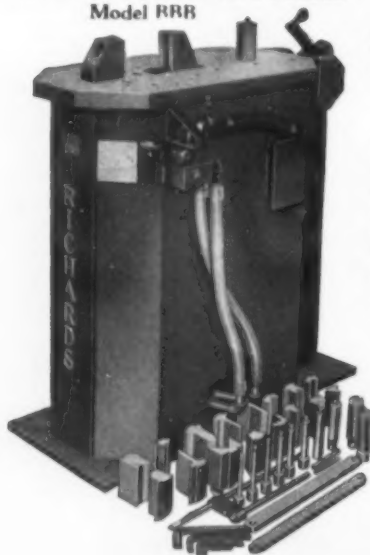
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USE READER SERVICE CARD; INDICATE A-6-244-1

Multiform BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model RRR



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to 1/4" thick by 4" wide. We also build smaller hand or air operated models for forming up to 1/8" x 1 1/2" material.

Send for illustrated folder TE-5

903 North Pitcher St.
Kalamazoo, Michigan

J. A. RICHARDS CO.

USE READER SERVICE CARD; INDICATE A-6-244-2

NOW AUTOMATIC Hole DEBURRING



AUTOMATICALLY
DEBURRS PARTS
LIKE THESE!

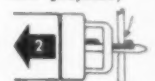
with NOBURMATIC TOOL



New Noburmatics deburr and chamfer front and inaccessible back hole faces in ferrous and non-ferrous sheets, plates, extrusions, castings and forgings in **one automatic operation**. Used in drill motors or stationary machine tools, Noburmatics produce uniform deburring with high accuracy, increase production line speed. Made in all drill sizes from 1/8" (.125) to F(.256).



Entry Noburmatic enters hole, advances to limit stop, DEBURRS FRONT FACE. (Rear cutter now projects.)



Withdrawal BACK FACE DEBURRED. Cutter automatically retracts. Tool ready for next cycle.

For Free Bulletin and Full Details, Write Today!

NOBUR MANUFACTURING COMPANY
717 N. VICTORY BLVD., BURBANK, CALIF.

USE READER SERVICE CARD; INDICATE A-6-244-3

NEW!

"Auto-tap"
TRADE MARK
LEAD SCREW TAPPING HEAD
for Your Drill Press

New Features

- ★ Quick-change lead screw
- ★ New type 'V' clutch
- ★ Positive depth control
- ★ Positive-drive tap

Model 205 for #0 to 5/16" taps
Model 210 for 10-32 to 3/4"

The new Auto-Tap Head guarantees precision tapping, more production, and less spoilage with unskilled help.

Send for Details

Automatic Methods INC.
944D West Grand St., Elizabeth, N. J.

LEAD SCREW TAPPING HEADS and ATTACHMENTS

USE READER SERVICE CARD; INDICATE A-6-244-4

The Tool Engineer

Augmenting Miller's Quality-Famous Line of "Custom-Built" Cylinders...



Stock

AIR AND
HYDRAULIC

CYLINDERS

Available for Immediate Delivery...

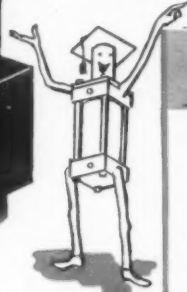
in the popular sizes, mountings and prices listed below

Any of the interchangeable "stock" mountings illustrated can be easily attached to Basic Model 53 with the tie rod nuts in a few moments. This gives you a wide selection of models for **immediate use** — and permits easy conversion to other models for **future re-use**. You save delivery and production time, investment cost and storage space.



ORDER DIRECTLY FROM
THIS LIST

"Stock" Cylinders are shipped as Basic Model 53. Your selection of Mounting Attachments are shipped (unattached) with cylinders. Prices are F.O.B. our plant.

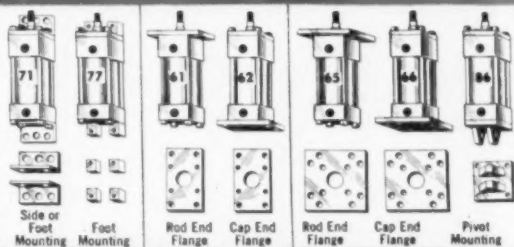


BASIC
CYLINDER
PRICES ONLY



Tie Rods Extended
Rod End

PRICES OF MOUNTING ATTACHMENTS ONLY



Bore	Stroke	Cushion	AIR A53	HYD. H53	AIR A77 A71	HYD. H77 H71	AIR A61 A62	HYD. H61 H62	AIR A86	HYD. H65 H66 H86
1 1/2"	2"	Non		\$58.50		\$2.90		\$8.20		\$14.35
1 1/2"	4"	Non		60.70		2.90		8.20		14.35
1 1/2"	6"	Non		62.90		2.90		8.20		14.35
1 1/2"	8"	Non		65.10		2.90		8.20		14.35
1 1/2"	11"	Non		68.40		2.90		8.20		14.35
2"	2"	Non	\$37.70		\$2.05		\$4.60		\$6.90	
2"	4"	Non	39.40		2.05		4.60		6.90	
2"	6"	Non	41.10		2.05		4.60		6.90	
2"	8"	Non	42.80		2.05		4.60		6.90	
2"	11"	Non	45.35		2.05		4.60		6.90	
2"	3"	Both	62.05	94.50	2.05	2.95	4.60	8.55	6.90	17.05
2"	4"	Both	63.75	97.00	2.05	2.95	4.60	8.55	6.90	17.05
2"	7"	Both	65.45	99.50	2.05	2.95	4.60	8.55	6.90	17.05
2"	9"	Both	67.15	102.00	2.05	2.95	4.60	8.55	6.90	17.05
2"	13"	Both	70.55	107.00	2.05	2.95	4.60	8.55	6.90	17.05
2 1/2"	2"	Non	41.45	73.30	2.25	2.95	4.80	9.00	7.55	19.80
2 1/2"	4"	Non	43.35	76.00	2.25	2.95	4.80	9.00	7.55	19.80
2 1/2"	6"	Non	45.25	78.70	2.25	2.95	4.80	9.00	7.55	19.80
2 1/2"	8"	Non	47.15	81.40	2.25	2.95	4.80	9.00	7.55	19.80
2 1/2"	11"	Non	50.00	85.45	2.25	2.95	4.80	9.00	7.55	19.80
3 1/4"	3"	Both	77.80	126.85	2.55	4.35	6.35	11.75	9.90	23.10
3 1/4"	5"	Both	79.80	129.85	2.55	4.35	6.35	11.75	9.90	23.10
3 1/4"	7"	Both	81.80	132.85	2.55	4.35	6.35	11.75	9.90	23.10
3 1/4"	9"	Both	83.80	135.85	2.55	4.35	6.35	11.75	9.90	23.10
3 1/4"	13"	Both	87.80	141.85	2.55	4.35	6.35	11.75	9.90	23.10
4"	2"	Non	56.25	106.00	2.85	5.15	6.70	12.90	11.05	26.80
4"	4"	Non	58.85	109.40	2.85	5.15	6.70	12.90	11.05	26.80
4"	6"	Non	61.45	112.80	2.85	5.15	6.70	12.90	11.05	26.80
4"	8"	Non	64.05	116.20	2.85	5.15	6.70	12.90	11.05	26.80
4"	11"	Non	67.95	121.30	2.85	5.15	6.70	12.90	11.05	26.80
5"	3"	Both	98.25		3.15		7.00		12.35	
5"	5"	Both	101.65		3.15		7.00		12.35	
5"	7"	Both	105.05		3.15		7.00		12.35	
5"	9"	Both	108.45		3.15		7.00		12.35	
5"	13"	Both	115.25		3.15		7.00		12.35	
6"	2"	Non	80.60		3.35		7.25		13.55	
6"	4"	Non	84.90		3.35		7.25		13.55	
6"	6"	Non	89.20		3.35		7.25		13.55	
6"	8"	Non	93.50		3.35		7.25		13.55	
6"	11"	Non	99.95		3.35		7.25		13.55	
8"	3"	Both	157.35		3.70		10.55		17.60	
8"	5"	Both	162.45		3.70		10.55		17.60	
8"	7"	Both	167.55		3.70		10.55		17.60	
8"	9"	Both	172.65		3.70		10.55		17.60	
8"	13"	Both	182.85		3.70		10.55		17.60	

**Sales and Service
From Coast to Coast!**

Consult your local
directory or write us
direct for the name
of our representative
for your area



Complete Miller "custom-built" line includes: air cylinders, 1 1/4" to 20" bores, 200 psi operation; low pressure hydraulic cylinders, 1 1/4" to 6" bores for 500 psi operation, 8" to 14" bores for 250 psi operation; high pressure hydraulic cylinders, 1 1/4" to 12" bores, 2000-3000 psi operation. All mounting styles available. Also, a complete line of Fluid Pressure Boosters and Accumulators.



MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

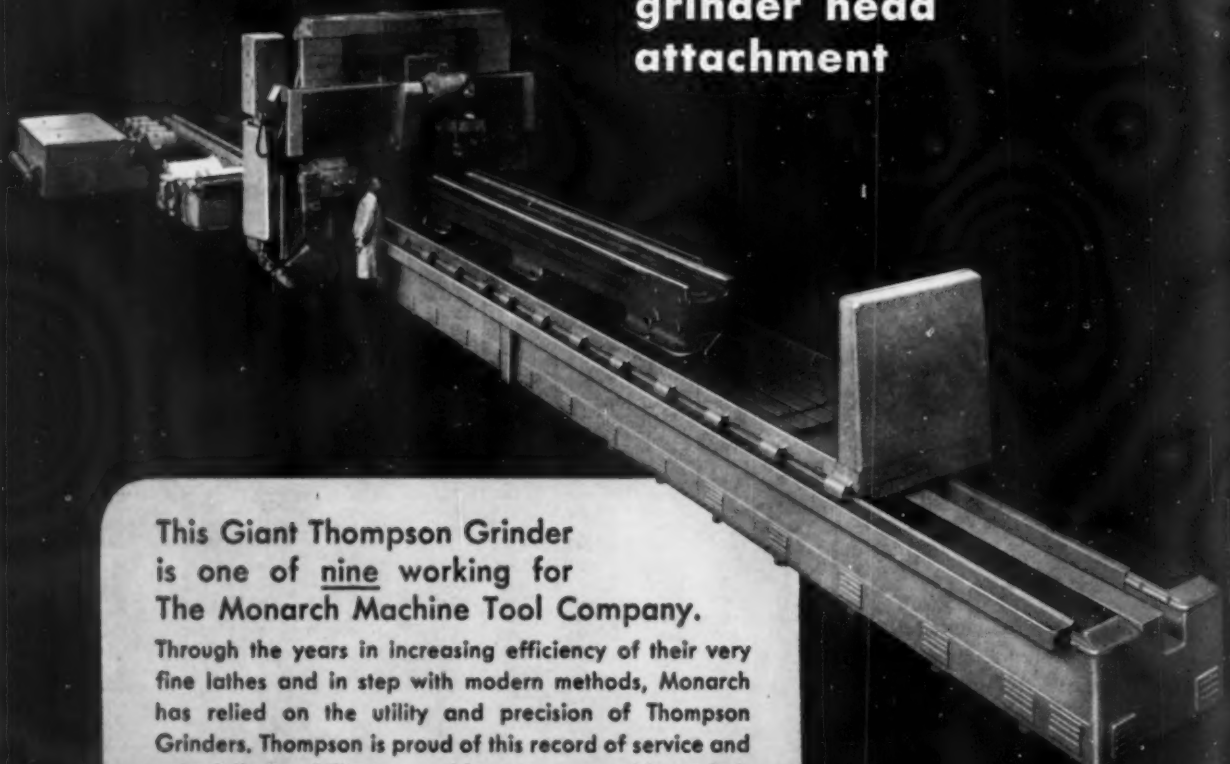
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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS

Monarch

Replaces a planer
equipped with
grinder head
attachment



This Giant Thompson Grinder
is one of nine working for
The Monarch Machine Tool Company.

Through the years in increasing efficiency of their very fine lathes and in step with modern methods, Monarch has relied on the utility and precision of Thompson Grinders. Thompson is proud of this record of service and especially its ability to provide extreme precision grinding on this largest of all surface grinders.

INSTALLS WORLD'S LARGEST...

Surface Grinder

precision grinding lathe bedways up to 32 ft. long to a tolerance of five ten-thousandths of an inch .0005"

The precision of Thompson Way Grinders is exemplified in this giant new machine recently installed in the plant of the Monarch Machine Tool Company of Sidney, Ohio. Monarch lathes are known the world over for their extreme efficiency and accuracy, therefore, in the machining of the bedways of their longest machines they had to depend on grinding equipment that maintained exceptional accuracy over entire surfaces up to 32 feet in length. This accuracy is perfectly maintained on this Thompson Way Grinder to five ten-thousands of an inch.

Thus, this surface grinder is not only the World's largest but size for size, one of the World's most accurate machines. The overall length is 79 feet and it measures 13 feet high and 13½ feet wide. Yet in spite of its size all operations are easily controlled by a single operator automatically from the convenient suspended push button control panel. This is typical of Thompson centralized control available with all types and sizes of Thompson Grinders. It will pay you to consult Thompson Engineers in finding an economical solution to *your* problems.

Have Thompson Engineers
solve your grinding
problems

THE THOMPSON GRINDER COMPANY
Springfield, Ohio

**Thompson
Grinders**

NOW Cut Your Carbide Tooling Costs in Half!

See chart below to determine how much you can save.



New V-R Toolholder for "Throw-Away" blanks is available either with Negative Rake or Neutral Rake. Styles are available for triangular, square and round "Throw-Away" blanks.

with V-R Toolholders* and "Throw-Away" Blanks!

- No Chipbreaker Grinding
- Lower Tool Inventory
- Available with Negative or Neutral Rake
- No Carbide Grinding
- Cutting Edge Automatically Positioned
- Another Cutting Edge Quickly Available

More Economical Than Brazed Tools

Compare The Cost Per Cutting Edge...

The costs on a brazed tool's useable cutting edges are:

1. Original cost of the tool
2. Cost of each regrind
3. Number of regrinds obtainable

Formula for computing cost per cutting edge

$$\frac{(\text{Cost of Tool}) + (\text{No. of regrinds} \times \text{cost per grind})}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

Compute the cost per cutting edge for a typical brazed tool you use and compare it with cost per cutting edge of a "Throw-Away" blank!

V-R "Throw-Away" Blank Cost Per Cutting Edge								
"Throw-Away" Blank Style and Size	Triangular				Square		Round	
	1/4" IC	3/8" IC	1/2" IC	5/8" IC	3/8" sq	1/2" sq	3/8" R	1/2" R
UTILITY Class for NEGATIVE RAKE Type	.06	.10	.20	.33	.07	.15
UTILITY Class for NEUTRAL RAKE Type	.12	.20	.40	.66	.15	.30
PRECISION Class for NEGATIVE RAKE Type	.10	.17	.27	.42	.13	.23	.06	.11
PRECISION Class for NEUTRAL RAKE Type	.20	.34	.54	.84	.27	.47	.16	.26



V-R Toolholders are also available for holding triangular, square and round inserts up to 1 1/2" long. See Toolholder Catalog VR-435.

Write Today for New Toolholder Catalog and Price List VR-436

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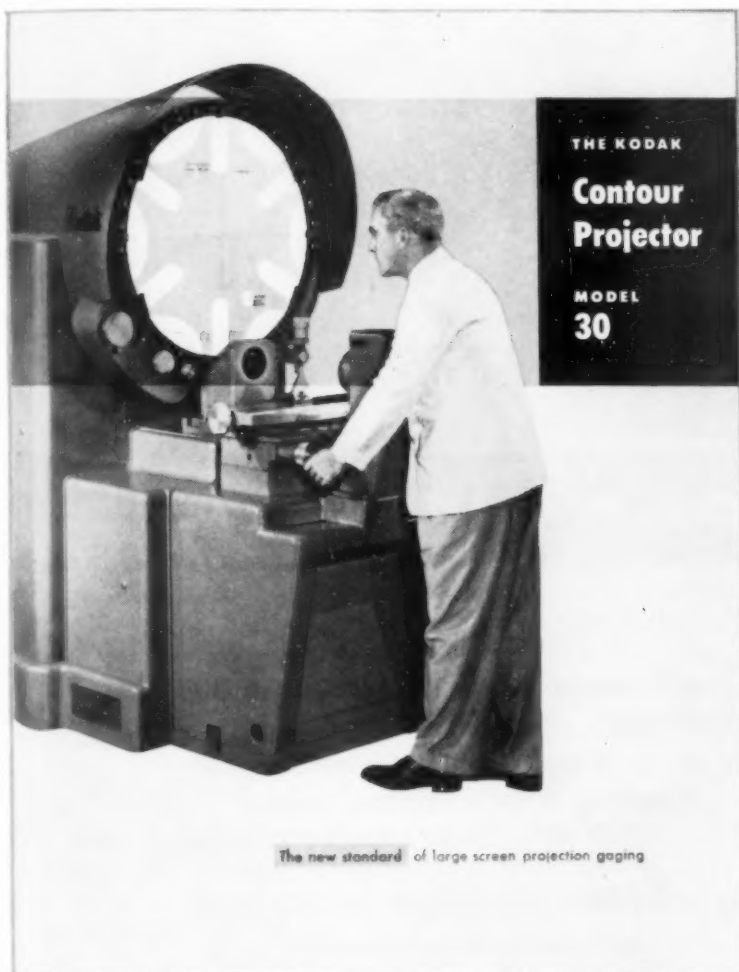
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* Patent Pending

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FAMILY**



The P-4 AUTOMATIC



For work within its capacity (pieces $\frac{5}{32}$ " in diameter and $1\frac{1}{2}$ " long) we offer a machine of deadly accuracy and high production . . . 10 speeds to 12,000 RPM.

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The many other advantages are described in Catalog sent on request.

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Since our introduction of the "ground from the solid" process, Bath has eliminated distortion due to hardening. The steel blank is heat treated to the proper uniform structure before grinding. Controls maintain just the right degree of heat treating temperatures . . . then, all grinding operations are performed, assuring accuracy and complete dependability.

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Another thing you can depend on at Bath, is our competent engineering staff . . . always ready to work on tap problems and help you meet your specific thread requirements. Once tap dimensions are determined . . . you can depend on exact duplication, every time you order. Try us and see!



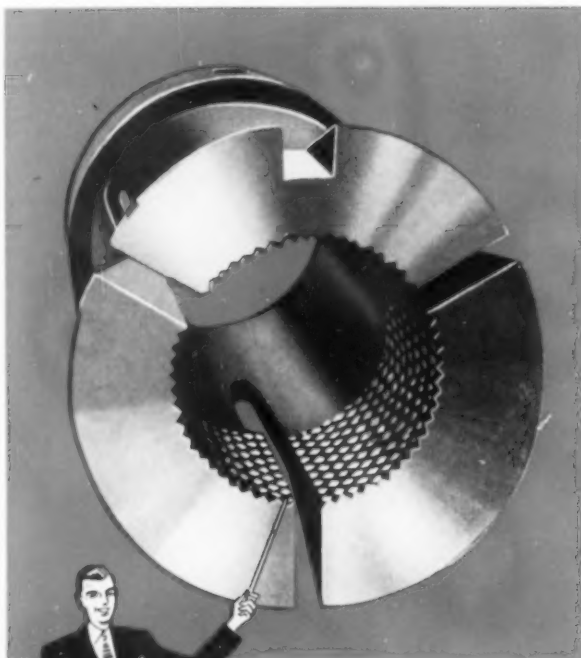
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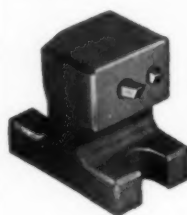
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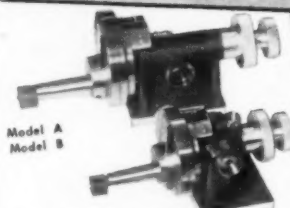
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
It pays to look beyond the socket when you buy Socket Screws. Compare every detail of product and service, and you'll find P-K Socket Screws take top honors in every test for quality, performance, economy.

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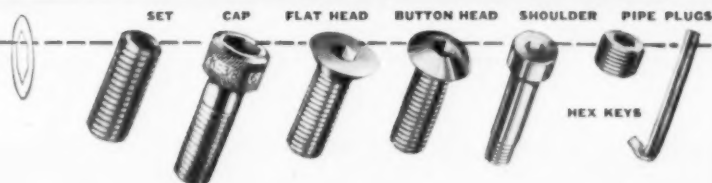
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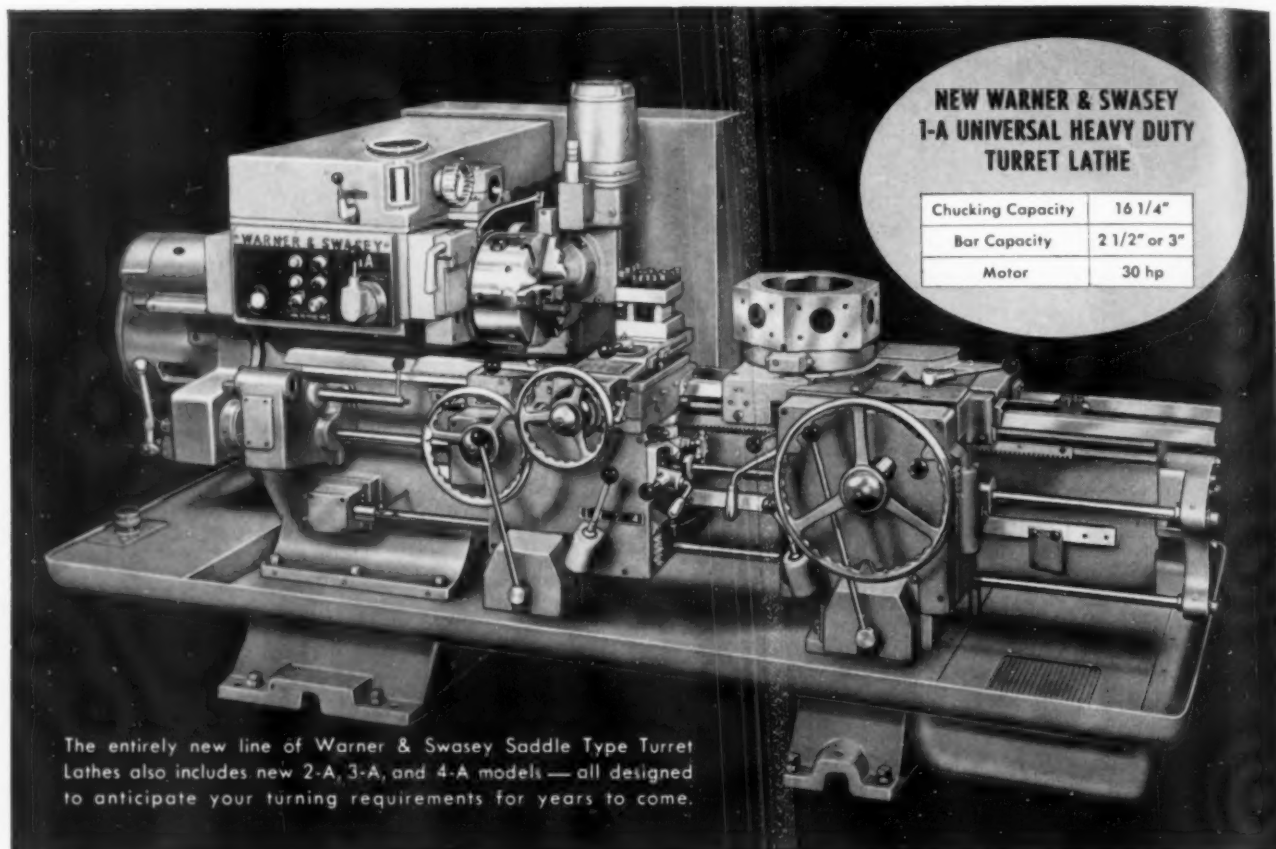
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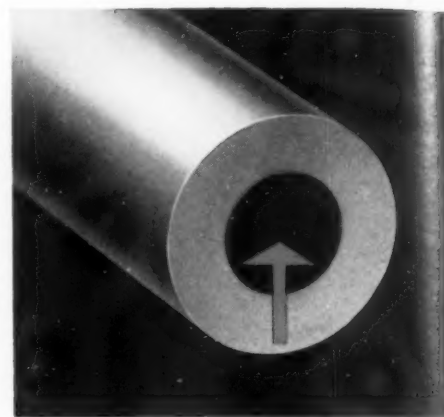
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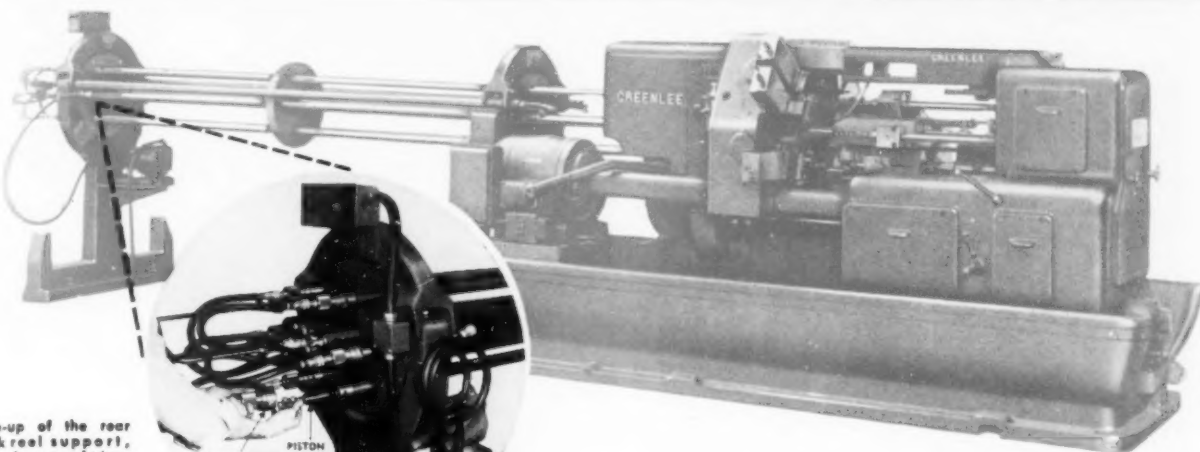
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GREENLEE

Automatics



Close-up of the rear stock reel support, showing a piston (which follows and pushes the stock) being inserted in a stock tube. The air hoses are equipped with speed couplers.

BAYONET TYPE COUPLING PISTON

This method of feeding out stock was developed primarily for the many screw machine jobs that require either multiple feed-out arrangements, greater feed-out length than the conventional mechanical arrangement will permit, or for machining parts made from ground stock where pusher marks would be objectionable. It can be adapted to all 1" and 1 1/8" GREENLEE Automatics.

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(PNEUMATIC STOCK FEED)

FEEDS OUT STOCK TO 16 1/2"

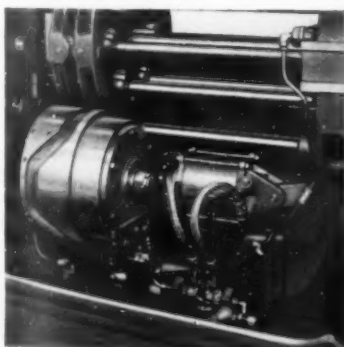
PROVIDES MULTIPLE FEED-OUT

ELIMINATES STOCK SCORING

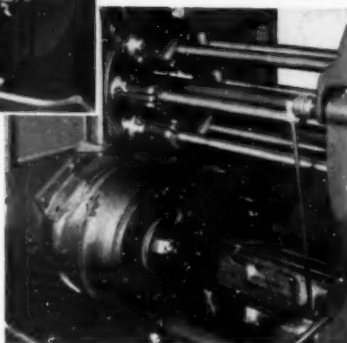
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ELIMINATES STOCK PUSHERS

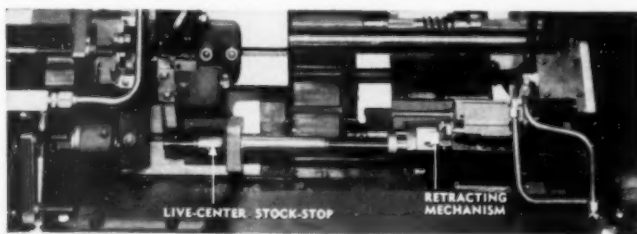
ELIMINATES FEED-OUT CAMS



Left: One method of opening and closing the collets for multiple feed-out. The air cylinder, controlled by a plate cam on the cam drum, actuates the collet-operating rings. Various arrangements can be made, depending on the requirements of the particular job being set up.



Right: Simplification of the feed cam drum possible with air feed, where the collets are to be opened by the conventional mechanical arrangement between the 6th and 1st positions. Feed-out is usually against a standard fixed stock stop in such cases.



LIVE-CENTER STOCK-STOP

RETRACTING MECHANISM

Above: A method used for feeding out stock during the machining cycle. The stock is fed out against an adjustable live-center stock-stop arrangement. When the collet jaws are closed, the live-center retracts and permits the stock to rotate freely and index to the next position.

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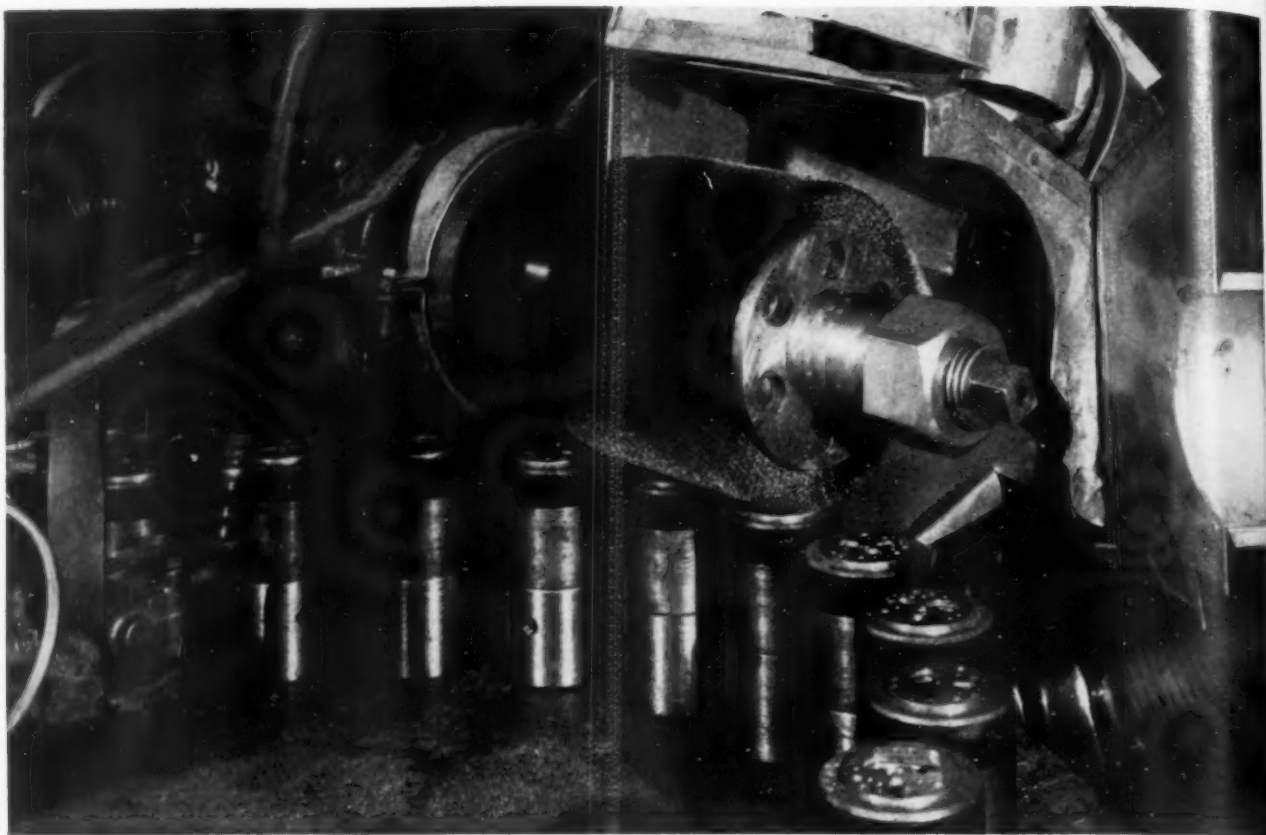


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June 1954

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-263

263



How to brush down finishing costs *automatically*

Power Brushing finishes both sides of these brass discs at a rate of 15,000 per machine per eight-hour day. It does a better, more uniform job many times faster than hand methods.

Parts are placed on spindles which rotate at 60 r.p.m. The table also turns at about one revolution in 25 seconds bringing the Osborn Economy® Section Brushes into contact with each part in turn. Spindles stop rotating as they approach the loading station, where a mechanism lifts finished parts and air pressure blows them into a chute.

A similar automatic operation with Osborn Power Brushing may improve the quality and speed of *your* cleaning, finishing and deburring operations . . . whether you process large parts or small . . . made of metallic or non-metallic materials. Ask your nearby **Osborn Brushing Analyst** to appraise *your* possibilities. Write to *The Osborn Manufacturing Company, Dept. K-9, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

FREE: New booklet on deburring with Osborn Power Brushing. Ask for your copy.



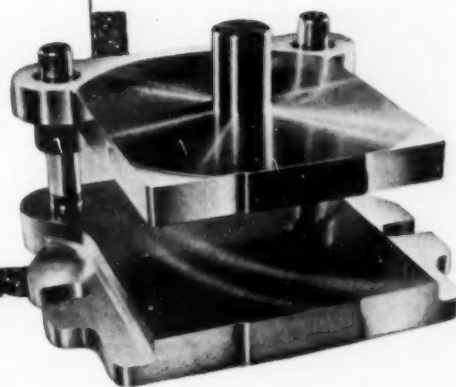
The finished part. Osborn Power Brushing removes feather burrs and blends surface junctures.

Osborn Brushes



OSBORN BRUSHING METHODS • POWER, MAINTENANCE AND PAINT BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

World's fastest die set service in action



Now—Danly unites mass production techniques with the precision touch of craftsmanship to bring you the fastest die set service... ever.

Never before has there been a die set service as fast as the one that Danly now offers to you. Unique in concept, the system had its beginning some years ago when Danly originated its network of nationwide Danly Branches. Under such a system the main Danly Plant in Chicago provided thousands of *interchangeable* die set parts to Danly Branch Plants. It meant that such parts were easily assembled into standard die sets and then quickly delivered to meet the requirements of any tooling program. But, as buyers recognized the convenience of Danly service, demands on the Chicago Plant grew to exceed capacity. The solution? ... an unprecedented move in the die set field. Danly put die set manufacture on a mass production basis with no sacrifice of famous Danly precision. It was accomplished with amazing new facilities in the form of two complete production lines devoted exclusively to high speed, precision die set production. The next time you put one or a dozen Danly Die Sets on order, expect to get fast delivery from any Danly Branch, expect to get die sets unequalled in precision. You can expect it and you'll get it... when it's Danly.



Here's where faster die set service begins, on Danly's high speed precision production lines... the finest mass production facilities in the die set field.



Here's where your order is received... in one of Danly's Branch Plants. Because all die components are close at hand, your order is filled immediately.

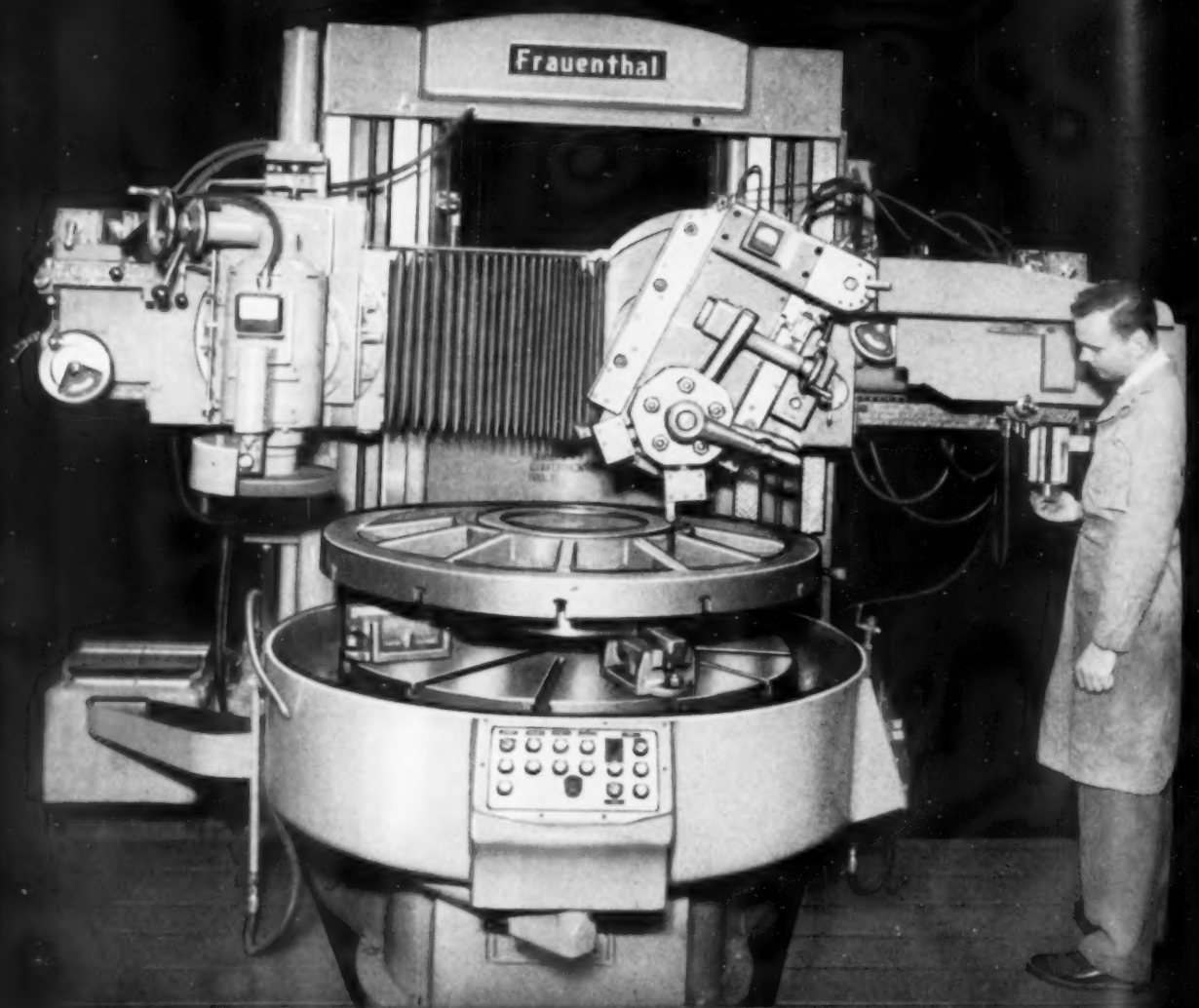


Fast, nationwide delivery from these plants

*CHICAGO 50	2100 S. Laramie Avenue
*CLEVELAND 14	1550 East 33rd Street
*DAYTON 7	3196 Delphos Avenue
*DETROIT 16	1549 Temple Avenue
*GRAND RAPIDS	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
*LONG ISLAND CITY 1	47-28 37th Street
*LOS ANGELES 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
*PHILADELPHIA 40	511 W. Courtland Street
*ROCHESTER 6	33 Rutter Street

*Indicates complete stock.

announcing..



Frauenthal Division • THE KAYDON

The Frauenthal Series 3100 precision turning and grinding machine

NOW AVAILABLE FOR THE FIRST TIME — here's a machine specifically designed to perform finish turning and ultra-precision grinding operations. With it, you can produce accuracies previously considered impractical, with assured concentricity of related surfaces finished on a one-setup basis!

Originally designed to meet the exacting requirements of jet engine production, the Series 3100 machine is completely new from the ground up. Its unique design opens up new possibilities for machining large work-piece, close-tolerance jobs on a mass-production basis. The Series 3100 offers the entire metal-working industry exceptional new capacity for precision turning and precision grinding.

CHECK THESE IMPORTANT FEATURES

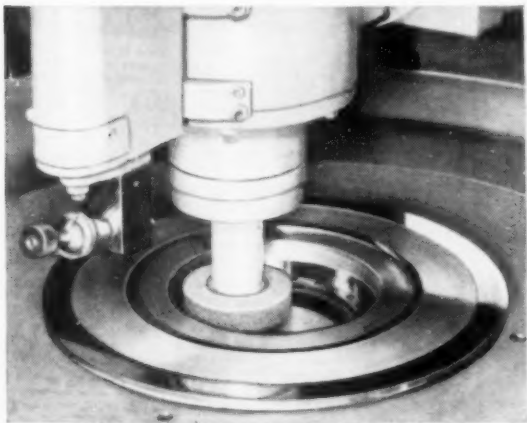
- Ultra-precision work-table bearings
- Hydraulically actuated turning slide
- Hydraulically actuated grinding slide
- Hydraulic grinding spindle
- Conveniently located controls and safety switches

... AND THIS OPTIONAL EQUIPMENT

- Hydraulic tracer control
- Electronic surface speed control
- Hydraulic wheel dressers for varied applications



Here, the operator uses a Series 3100 machine to bore out the inside diameter.



This closeup shows how the machine performs close-tolerance finish grinding of the workpiece's top surfaces and inside diameter.

May we help you?

If you'd like to have details on how the Series 3100 can offer you new tool room or production benefits — our engineers are at your service. Write for informative bulletin No. 301.



Frauenthal MULTIPLE-HEAD
SUPER-PRECISION
VERTICAL **Grinders**

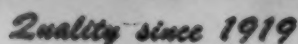
ENGINEERING CORP. • Muskegon, Michigan

extend the applications for
**Swanson TURRET INDEXING
UNITS**



Write for
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**Engineers and Builders of
Special precision machinery**



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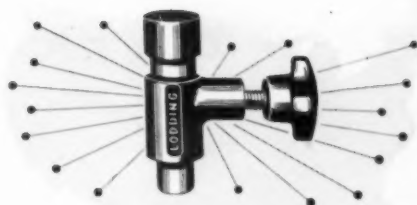
HIGH SPEED-GROUND THREAD

USE READER SERVICE CARD: INDICATE A-6-268-2

Pay by M.O.
check. P.O.'s acceptd. from D
firms. 1/2 deposit with C.O.D.
Prices FOB Los Angeles.

In Jig and Fixture Components . . .

Get It Quickly



Completely stocked coast-to-coast distributors provide immediate shipment of parts like this spring jack — you get them much faster than you can make them yourself!



STANDARDIZE

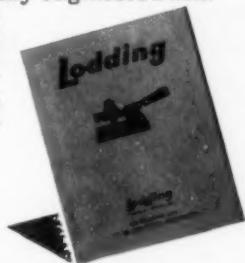
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YOU GET WHAT YOU WANT

Here at Lodding you will find the most complete line of standard assemblies and details offered by anyone — all the components necessary to standardize your engineering practice, save design and labor costs.

AND YOU GET THE BEST

All Lodding fixtures are carefully engineered and quality-built to provide long, reliable service. Forgings and powdered metal are used in many cases. Every Lodding fixture is Parkerized to prevent rust.



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THE STANDARD LINE
OF JIG AND FIXTURE COMPONENTS

Write for Catalog — includes full-scale layouts of every Lodding fixture.

Here is a picture of an...

OBSOLETE BORING SETUP!



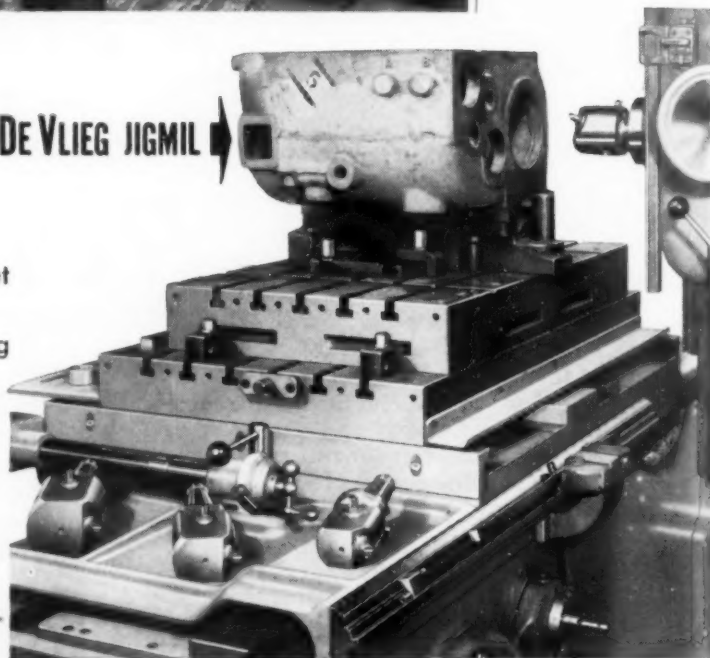
THIS PICTURE—
taken in
a well known
machine tool plant
illustrates
the old method
of boring
turret lathe
headstocks with
a costly inflexible
box jig and
a mass of
special tooling

The Modern Method

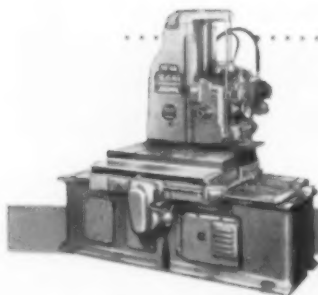
"JIGLESS BORING"—THE SAME PIECE ON A DEVLIEG JIGMIL

- Eliminated expensive boring jig
- Reduced machining time
- Improved accuracy with a resultant cut in assembly costs
- Permitted the use of simplified tooling

If your shop is burdened with costly boring jigs and special tooling, it will pay you to investigate the DEVLIEG SPIRAMATIC JIGMIL!



Come to Detroit... see a practical demonstration of the JIGMIL Technique . . .



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A request on your company letterhead will bring a copy of our comprehensive Illustrated Catalog

Get on the right track to **BEAT WEAR** ...use **AMPCO^{*} METAL**

ONE of the easiest ways to beat wear is to use Ampco Metal. That's why more and more designers and plant-operating men turn to these versatile aluminum-bronze alloys. They know that Ampco Metal builds extra toughness and stamina into their machines — toughness and stamina that mean longer service life, more dependable performance, lower costs.

And unusual resistance to wear isn't the whole story. Ampco Metal has high compressive strength — doesn't squash out. It resists abrasion, erosion, corrosion. It has high impact and fatigue values, and excellent bearing qualities.

You can get Ampco Metal in practically any form you need—sand and centrifugal castings, sheet, plate, forgings, bars, tubes, welding wire and electrodes.

Beat wear! Use Ampco Metal in both your product and plant — for that all-important extra margin of safety and dependability. For the complete story, contact your nearest Ampco field engineer or send coupon.

*Reg. U. S. Pat. Off.

Tear out this coupon and mail today!

Ampco Metal, Inc.

MILWAUKEE 46, WISCONSIN



West Coast Plant
BURBANK, CALIFORNIA

mettle

LET AMPCO PROVE ITS METAL



Nordberg Mfg. Co.
Milwaukee, Wisconsin

The Product:

Nordberg Hydraulic Power Jack used to lift rails and ties from roadbed during reballasting or resurfacing.

The Problem:

To keep wear in the moving parts of the hydraulic rams to a minimum. Because the piston and gland act as guides, close tolerances must be maintained. In addition, the hydraulic ram utilizes pressures of 3000 psi and, although the piston ram has "O" rings with back-up washers, extremely close fits must be maintained between piston and gland to hold this pressure.

The Solution:

AMPCO METAL for both piston and gland. Thanks to the ability of Ampco Metal to resist wear, proper clearances and tolerances are maintained.

The Results:

The result—dependable performance, greater output.

IT'S PRODUCTION-WISE TO AMPCO-IZE

Nordberg Track Jack in operation. Machine consists basically of two hydraulic rams, each capable of lifting 24,000 lbs. Ampco Metal is used in the moving parts of the hydraulic rams because of its excellent resistance to wear.

AMPCO METAL, INC., Dept. TE-6, Milwaukee 46, Wisconsin

I'm interested. Send me your free Ampco Metal literature giving descriptions and general applications of Ampco Metal.

Name.....Title.....

Company.....

Company Address.....

City.....(.....) State.....

D-13A

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ABOUT **WALES HOLE PUNCHING UNITS**

MONEY AND TIME SAVING FEATURES . . .

Call on Wales-Strippit engineers before putting holes in angles, channels, sheets by any other method.

"NOT ONLY PAID FOR THESE WALES UNITS AND THE PRESS BRAKE BUT ALSO MADE OUR NORMAL PROFIT ON THE JOB"

"SETUPS WITH WALES UNITS ARE 8 TIMES FASTER THAN OUR FORMER GANG PUNCHING METHODS"

"ABLE TO DOUBLE THE RATED PRESS CAPACITY BY STAGGERING SHUT HEIGHT OF WALES UNITS WITH CAPS ON TOP OF PUNCHES"

"ELIMINATE STRIPPING PROBLEMS, SPOILED WORK FROM IMPROPER STRIPPING, AND BROKEN PUNCHES"

BLOOMER HEATING & VENTILATING CO.

Contractors-Fabricators

1237 WEST 47TH STREET, CHICAGO 20, ILL.
FEDERATION 9-2222

February 26, 1954

Wales-Strippit Corporation
408 Madison Avenue
Oak Park, Illinois

Attention: Mr. Homer C. Gray

Gentlemen:

Very seldom in the operation of a fabricating plant have I come across such cost and time saving opportunities as have been made possible by Wales Hole Punching Units.

To give you a little background, my company bid a job, based on our former gang punching method of tooling, and after we received the order as low bidder, I investigated and bought Wales Units. In addition, we purchased another press brake. The cost records show that we not only paid for these Wales Units and the press brake with this job but also made our normal profit on the job. We also bettered our delivery estimate by six weeks. Since the completion of this first order I have been using these same Wales Units on similar jobs.

My experiences have proven that setups with Wales Units are eight times faster than our former gang punching methods. Press downtime between setups is practically eliminated by mounting these Units on templates outside the press and just placing the entire assembly on the press bed, ready to start punching.

We were able to double the rated press capacity by staggering the shut height of Wales Units with caps on top of punches. Your Wales Units eliminate stripping problems, spoiled work from improper stripping and broken punches.

I thought you would be interested in these highlights of my experience with your tooling equipment and so I am enthusiastically passing along to you the results of my experiences with Wales Hole Punching Units. I am also enclosing photographs of your equipment in operation.

Very truly yours,

BLOOMER HEATING & VENTILATING COMPANY

E. Ellis

E. Ellis
Plant Superintendent

EE:rp

This letter from Bloomer Heating & Ventilating Company points out typical time saving and money saving advantages that are also experienced by the thousands of users of Wales Hole Punching Units.

Patented, independent, self-contained Wales Units permit the same group of units to be used and reused in unlimited hole punching setups without aligning punches and dies in the press.

Write for the fully-illustrated, functionally colored catalogs that completely describe Wales Hole Punching Units.

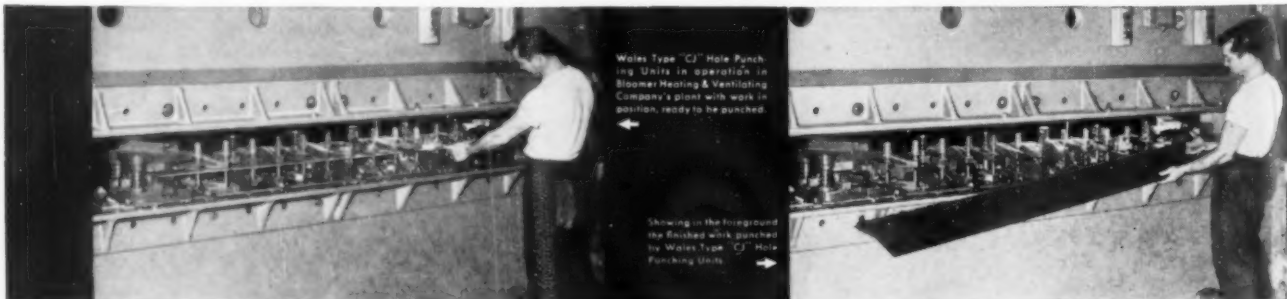
WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

393 Payne Avenue, North Tonawanda, N. Y.
(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment

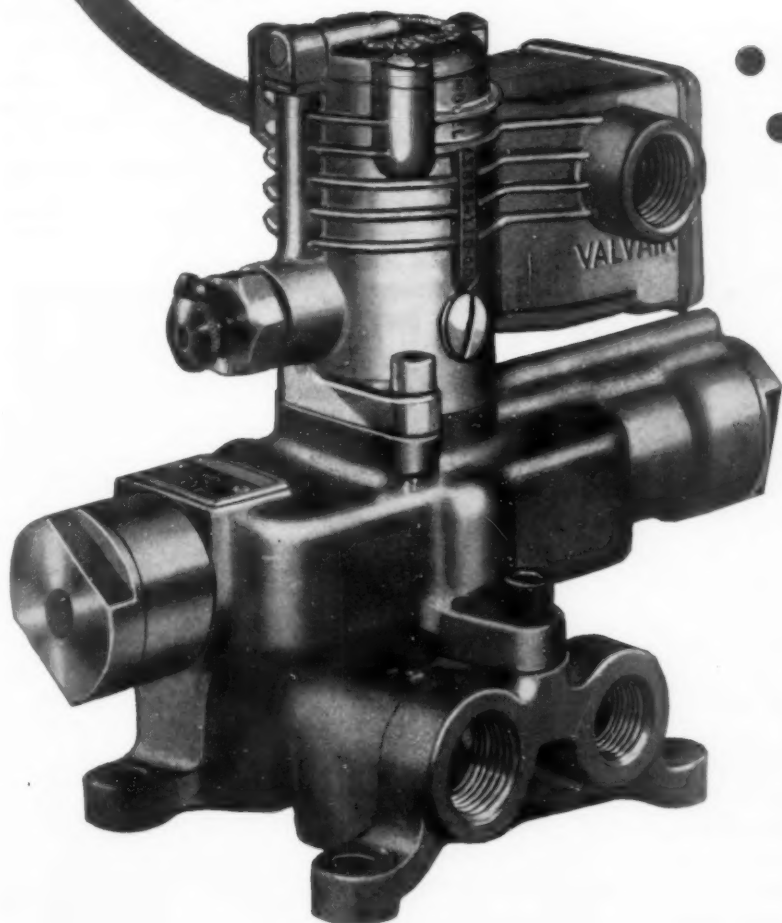


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SOLENOID PILOT OPERATED CONTROL VALVE

by **VALVAIR**

DESIGNED AND BUILT TO J. I. C. STANDARDS



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- Fully Enclosed
- Integral Junction Box

The Valvair line broadens again — with Speed King's exclusive features. All parts are totally enclosed. The Speed King will operate submerged in water or buried in sand. Simplicity! — only two moving parts. Molded coil — no wear or shorting out. 20,000,000-cycle life and more. Speed King is industry's most rugged and compact valve.

Other features: for pressures from 35 to 200 p.s.i. pneumatics, hydraulics, vacuum; complete line—2-way, 3-way, 4-way and 4-way-5-port (2-pressure) models; foot or sub-base (manifold) mounting; pipe sizes — 1/4", 3/8", 1/2", 3/4", and 1".

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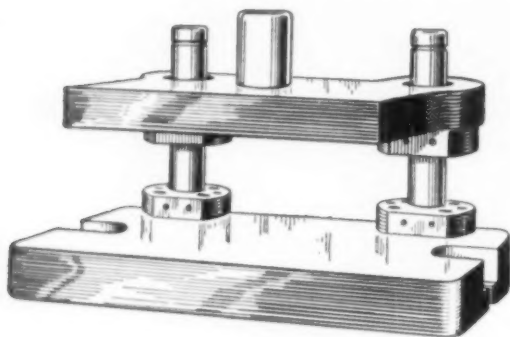
VALVAIR CORPORATION

Affiliate: Sinclair-Collins Valve Company
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BAUMBACH DIE SETS GET THERE FASTER!



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Detterbeck Quality Tools

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We specialize in
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- HIGH SPEED STEEL AND CARBIDE FORM TOOLS
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- SPLIT DRILL BUSHINGS
- CROSS SLIDE KNURL HOLDERS
- TOOL BITS
- BOX TOOLS
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Inasmuch as we manufacture cams and tools for the trade we obviously do so on a production basis. As a result we offer:

1. Superior type tools . . . at low cost.
2. Practical design based upon many years of experience.
3. Correct specifications which insures maximum service.

Your tool requirements in our hands is your guarantee of better tools at a great saving.

PROMPT DELIVERIES

Tool making with us is a routine matter. Special equipment . . . skilled hands . . . plus know how, enables us to fill orders in a minimum of time.

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Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools. Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

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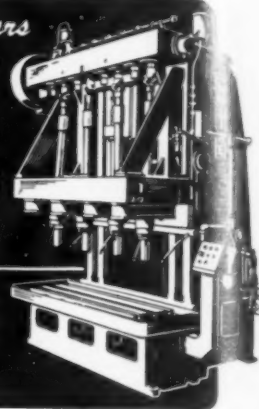
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MACHINE TOOLS

*Have Cut Production Costs
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No. HU68—Hydraulic
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type multiple spindle
drilling machine.



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FOR CUTTING

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AND INSPECTION

in GEAR PRODUCTION



THE FELLOWS GEAR SHAPER COMPANY, SPRINGFIELD, VERMONT

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APEX TOOLS

INSERTED-BLADE MILLING CUTTERS

Here's a **PRODUCTION** Cutter
for your

HEAVY DUTY JOBS

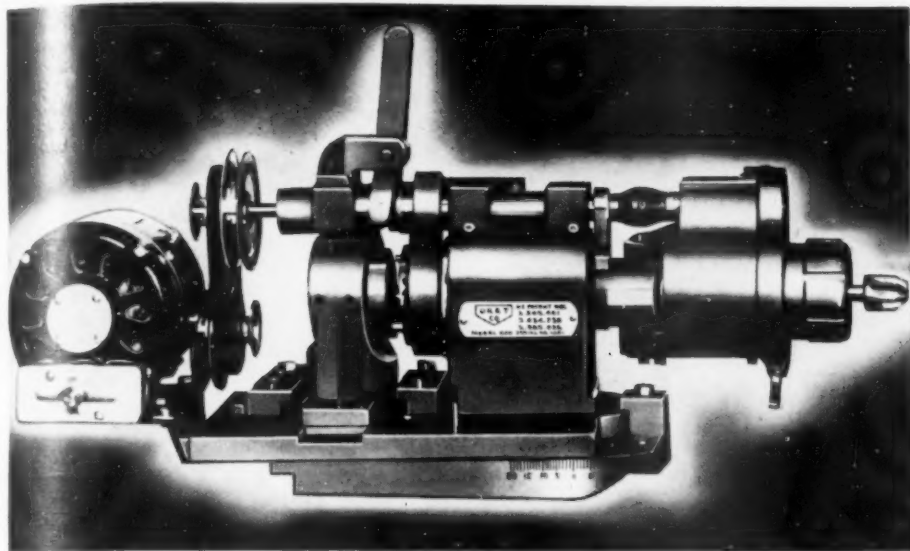
APEX offers many cutters for many jobs. Here's one that takes a big chip fast. It can be had with H.S.S., Stellite, Cobalt or Carbide tipped blades. These blades adjust automatically in two directions. No damage to carbide tips. Diameters from 8" to 24". We also make cutters for lighter work. Write for catalog.



APEX TOOL & CUTTER CO., Inc., Shelton 16, Conn.

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Precision CIRCULARITY GRINDING ATTACHMENT



Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

The Detroit Reamer & Tool Company Model 500 Circularity Grinding Attachment shown above is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.



*You Can Grind
Tools Like These*
on a **DETROIT REAMER
CIRCULARITY GRINDING
ATTACHMENT**

Special Cutting Tools of **DEPENDABLE QUALITY**



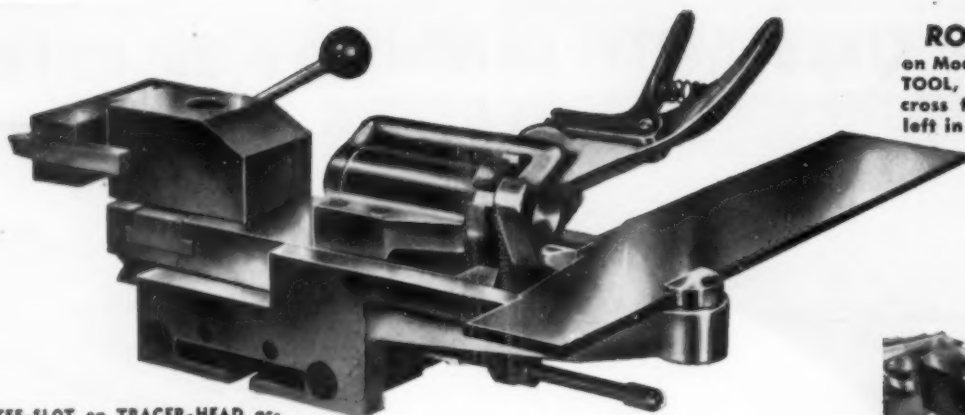
The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical

knowledge behind them are completely qualified to expertly handle your tool needs. For dependable cutting tools—specify Detroit Reamer & Tool Co.

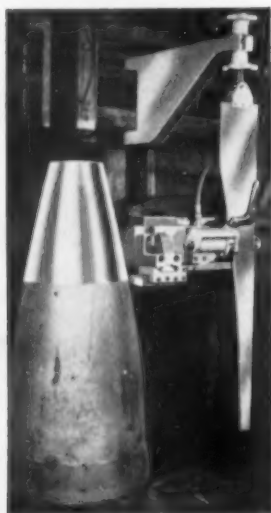
DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

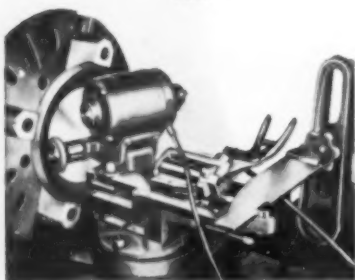




TEE-SLOT on TRACER-HEAD accommodates standard or quick change tool holders, square turrets, planer clapper box, grinding attachments, boring bars, etc.



BULLARD OPERATIONS
— Including outside and inside tracing. Tracer-head adapts to ram.



CONTOUR GRINDING
— Including internal and external contours.

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Faster—lower cost LATHE DUPLICATING WITH ANY ENGINE OR TURRET LATHE

- No complicated electronic or hydraulic controls.
- Quickly set up without making permanent alterations to the lathe. Does not tie up costly capital equipment.
- Gives complete working visibility and chip clearance.
- Positive stylus contact assured by air pressure to tool through a 3-way valve and pressure regulator. Uses shop pressure.
- Horizontal slide on Tracer Head operates between pre-loaded ball bearings. Precision built.
- Uses easily made, low cost, hardened templates.
- Proved in hundreds of shops of all sizes and in scores of major manufacturing and service industries for short and production runs.

MODELS NOW AVAILABLE

EL-1100 to fit lathes 9"-14".....Price \$375
M-1500 to fit lathes 16"-24".....Price \$725
EL-2000 to fit lathes 24" & larger.....Price \$975

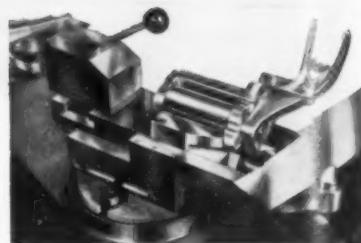
Prices subject to change without notice • Tool holder and template not included • Air valve and regulator supplied only with Models M-1500 and EL-2000.

ENGINEERING SERVICE

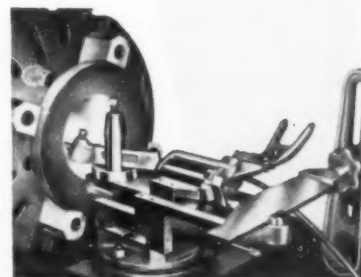
Our engineering department will be glad to advise you on any duplicating problem. Catalog and engineering bulletins on request.

ROTARY STYLUS

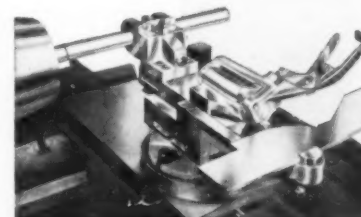
on Model M-1500 Lehigh **TRACER-TOOL**, illustrated at left, permits cross feed screw to be set and left in one position while successive pieces are machined or cuts are made. Speeds production. Assures accuracy even on old worn lathes.



O.D. CONTOUR TURNING
— and tapering. Unlimited radii.



CONTOUR FACING
— or any engine or turret lathe.



I.D. BORING
— consisting of various blended radii as well as 90° steps.

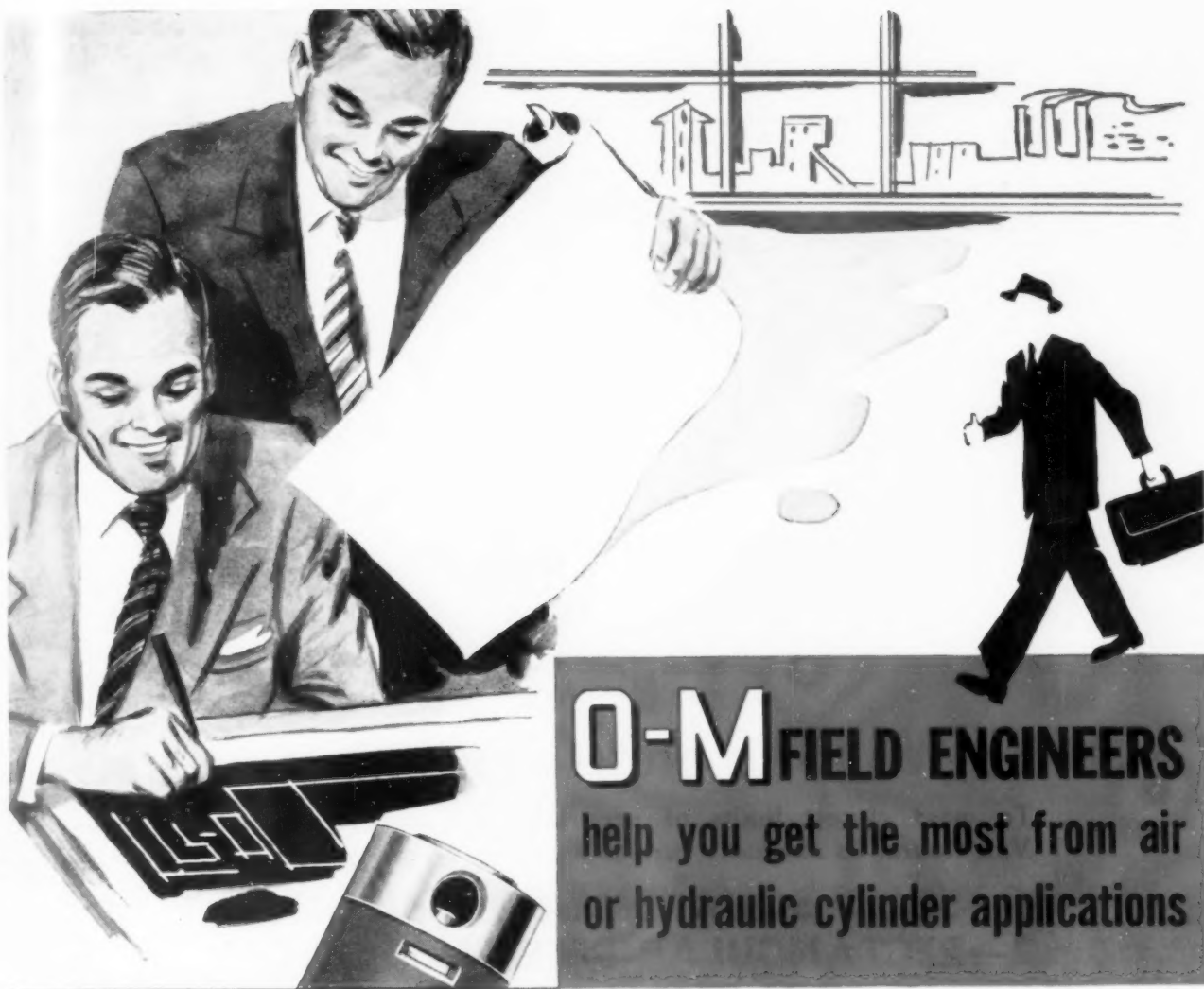
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fit where others won't!

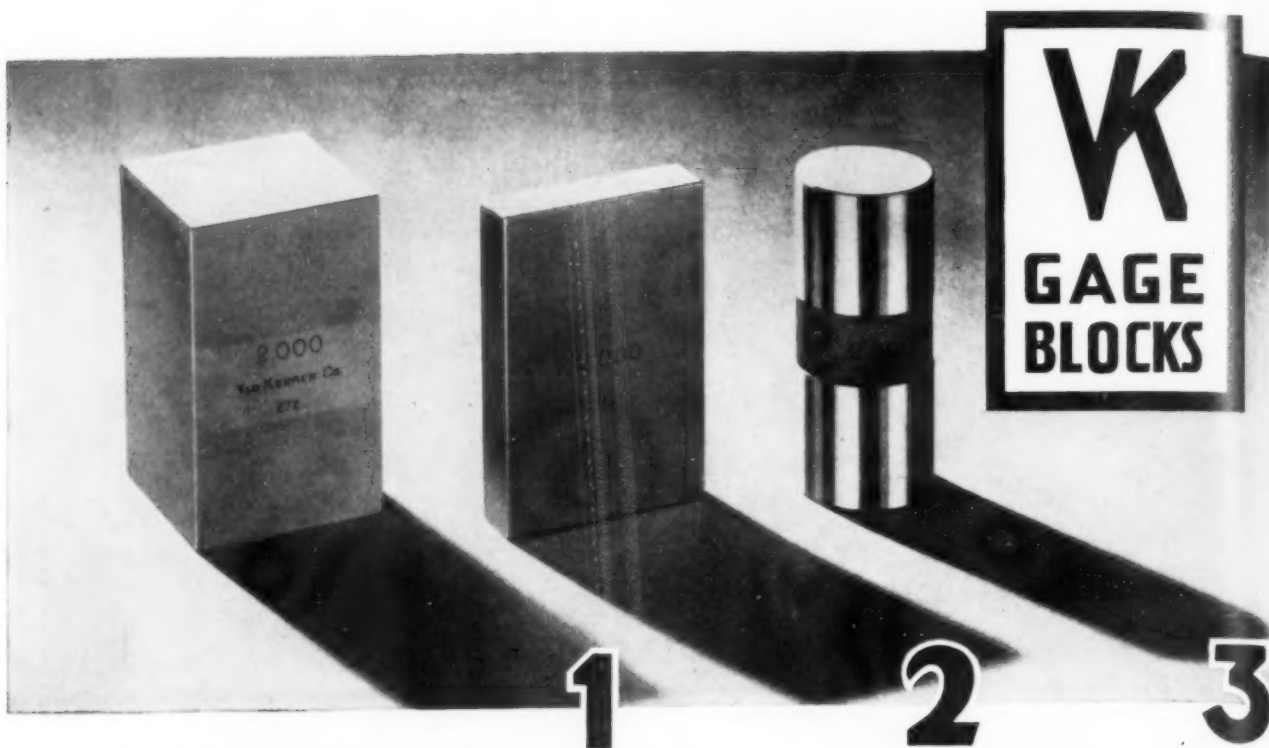
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O-M CYLINDERS available in full range of sizes (1½ to 8" bores) with standard, 2 to 1 or oversize rods. Completely interchangeable parts. Write for FREE catalog.



THREE WAYS to protect production accuracy

To meet closest limits of accuracy and protect production, Van Keuren is currently furnishing three types of gage blocks:

- 1—SOLID SQUARE MASTER BLOCKS
- 2—RECTANGULAR REFERENCE GAGES
- 3—MICROGAGES

Shipment on complete sets of any of these three types can be made within 60 days from receipt of order.

VK Solid Square Master Blocks are accurate to .000004" per inch of length and are designed for laboratory use or to standardize all shop dimensions. Large wearing surface; perfect parallelism. Available in 85- and 41-block sets and guaranteed unconditionally for 5 years not to exceed .0001" in wear.

VK Rectangular Reference Gages are guaranteed accurate to .000008" per inch of length and are designed for the inspection department or precision set up work. They are available in 81-block and 33-

block sets. Individual blocks from either of these sets can also be furnished. Certificate of size is also furnished with each set.

VK Microgages are accurate to plus .000012", minus .000008" per inch of length and are designed as working gages for shop use . . . to put accuracy at the machine. Wearing surface is 40% greater than that of rectangular gage blocks hence their long-wearing quality. Available in several set combinations.

Van Keuren Gage Blocks are fully described in Catalog and Handbook No. 35, yours for the asking by writing: The Van Keuren Co., 174 Waltham St., Watertown, Mass.

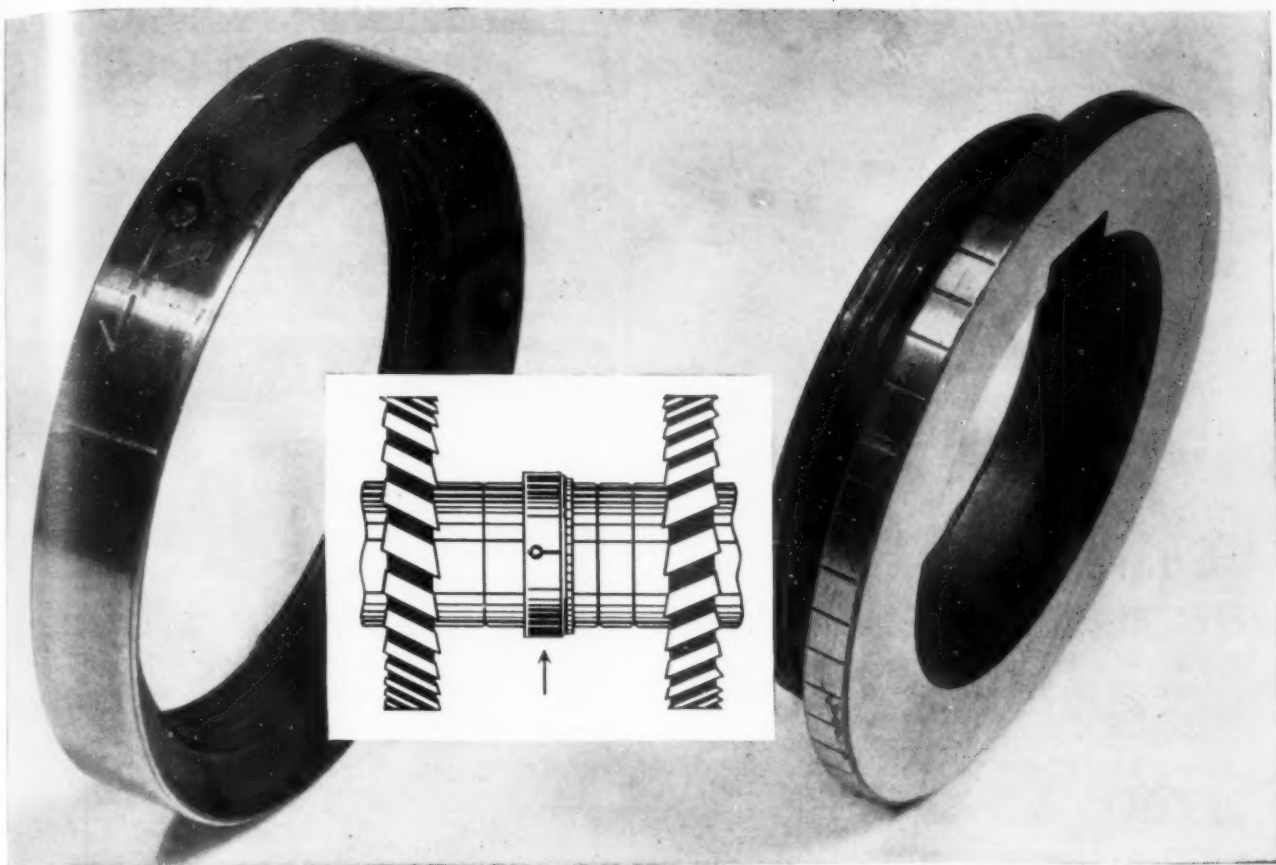


THE *Van Keuren* CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages





Switch to Graph-Mo® steel for spacing collars ends thread damage, eliminates thread grinding

NEAR perfect accuracy is the number 1 requirement of the Dayton Rogers Manufacturing Company, Minneapolis, for its micrometer adjustable spacing collars for milling machine cutter arbors. But when machine operators tightened the collars, they often exerted excessive arbor nut pressure that ruined accuracy and destroyed micrometer threads.

Then Dayton Rogers switched to Graph-Mo®, one of four Timken® graphitic tool steels. They found that Graph-Mo collars can take 20 tons pressure on both sides without disturbing accuracy or damaging threads. It's almost impossible for an operator to exert excessive milling machine arbor nut pressure. Micrometer accuracy is assured for the life of the spacing collars.

What's more, they discovered that the threads maintain their accuracy after heat treating. No thread grinding is necessary. Now Dayton Rogers uses Graph-Mo on all six collar sizes, from $\frac{3}{8}$ " to 1".

Users also report that Graph-Mo steel machines 30% faster, outwears other tool steels 3 to 1. It has a minimum tendency to pick up, scuff or gall. Responds uniformly to heat treatment.

For dollar-saving information on the use of Graph-Mo and other Timken graphitic tool steels for machine parts, dies, punches and gages, write for the new "Timken Graphitic Steel Data Book" just out. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

June 1954

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-279

279

Your **ONE** source
for **ALL** centers!



Guaranteed Accuracy! REPLACE WITH RED-E and be SURE!

RED-E offers the advantage of over 45 years of design, engineering and manufacturing experience. Only RED-E can serve your every Center requirement—regardless of size, taper, shank, style—and still **GUARANTEE ACCURACY!**

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CENTER Specialists since 1908

RED-E TOOLS READY TOOL COMPANY

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PRESSURE BLAST ABRASIVES

FOR ALL
WET-BLAST
EQUIPMENT!



- ★ EASIER TO AGITATE!
- ★ WILL NOT PACK!

75-5000 mesh range including aluminum oxide, quartz, silica flour, novaculite, garnet, etc.

Emulsifiers and inhibitors compounded with the abrasive... ready to use... no additives to buy or mix.

For use in all makes of wet-blast equipment.

Packaged in sturdy, fiber-board drums... 50 lbs., just right for a single operating charge.

Available from stock in all principal cities of U.S. and Canada... no freight charges.

Write for further information and the name of your nearest Pressure Blast distributor.

★ Developed by the manufacturers of Pressure-Blast wet-blasting equipment.

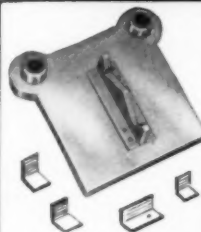


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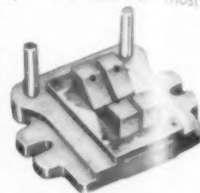
USE READER SERVICE CARD; INDICATE A-6-280-2

Punches and Dies

Angle Iron Cut-Off Die



Mounted in leader pin die set. Fits most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut **WITHOUT DISTORTION**. Just one of our many standard stock-dies.



Send for free illustrated catalog No. 154 AC.

Capacity: 2"x2"x1/4"

WARD Machinery Co. 564 West Washington Chicago 6

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DYKEM STEEL BLUE®

Stops Losses
making Dies and
Templates



Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.



Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-6-280-4

Wanted...

Machine tool designers
looking for real opportunity in
electrical circuit design and
hydraulic control functions

In a rut where you are? Feel your progress is being blocked? Then why not give your talents a fresh start in a new, modern facility, working for an aggressive, highly respected organization, a leader in its field for over 50 years.

Here's the opportunity you've talked about. Now do something about it. The permanent expansion of our business demands qualified design engineers who can combine imagination and ability in the practical solution of machining problems (milling, drilling, boring, etc.)

There are 15 openings in this exceptional opportunity for advancement and for doing the things you like to do best — create and develop fine production machine tools. Excellent pay range commensurate with experience.

added benefits...

profit-sharing retirement benefits after two years service... liberal health insurance package... good labor relations... and located within the state that's the "Playground of the Middle West."

For full particulars write to Box 600, **THE TOOL ENGINEER**, 10700 Puritan Avenue, Detroit 38, Michigan. Give name, age, marital status and summary of experience. We will correspond and interview if application is suitable. All communications held strictly confidential.

USE READER SERVICE CARD; INDICATE A-6-280-5

The Tool Engineer

Announcing Hanna Fluid Power Cylinders

750
SERIES

Completely New in Design and Engineering

PISTON

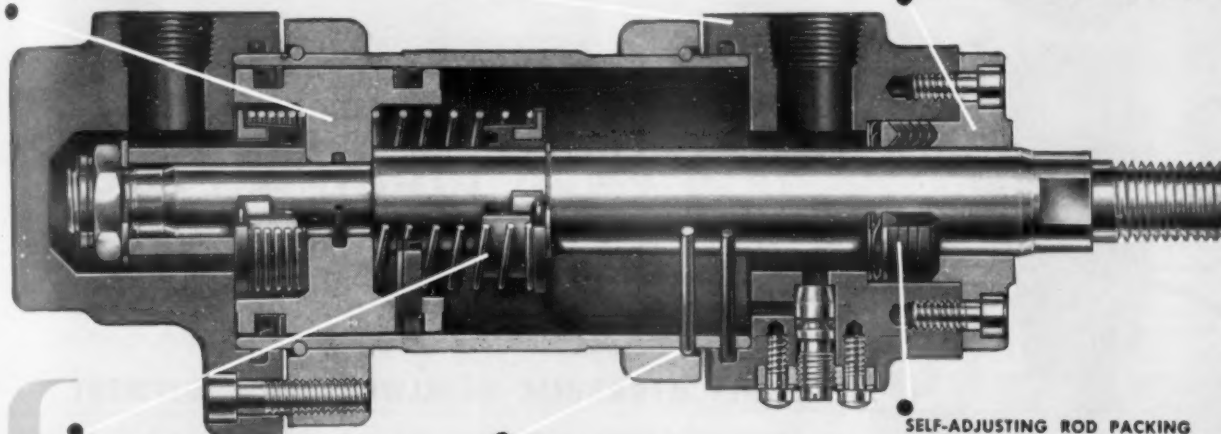
One-piece steel construction, treated for corrosion resistance and grooved for block Vee synthetic packings which reduce friction and give more positive sealing. Piston rod nut is self-locking to prevent loosening under vibration.

HEADS

Sturdy construction of high-strength alloy iron permits operation at higher pressures with an increased safety margin. Interior and exterior of heads have special treatment to resist corrosion.

BRONZE GLAND

Provides high-strength rod bearing. Generous length contributes to long life and minimum packing wear.



HANNA CUSHIONS

New design assures positive cushioning over full cushion stroke — allows immediate full flow on return stroke. Simple to adjust for exact speed.

KEEPER RINGS

Construction provides easy head rotation and interchange of heads and mountings.

SELF-ADJUSTING ROD PACKING

J.I.C. Standard — 4 chevrons and bronze adaptors. Specially designed spring pre-loads packing — automatically compensates for wear.

We didn't design these cylinders with a "new look" in mind — although they have it. What's most important to you is their new performance . . . new operating features . . . and new versatility. The above cross-section illustrates some of the new features . . . study it. And there are other important features too: such as ground, polished, chrome-plated rods of alloy steel; cold drawn brass cylinder tubes; cushion adjustment dials; large fluid passages; and J.I.C. Standard leak-proof "O" ring gaskets.

In performance you will like the greater power developed from dimensionally smaller units in the Hanna "750" Fluid Power line. Because of their broad capacity

range, air or hydraulic up to 750 p.s.i., you'll be sure of unusually smooth, dependable and lasting operation in the medium pressure ranges.

Yes, any way you look at them, inside or outside, Hanna "750" Fluid Power Cylinders are truly new. Together with their proved companions, Hanna LP and Hanna HP Cylinders, they offer a most complete range of capacities, sizes and mounting styles to exactly suit every cylinder application requirement.

Ask your Hanna Representative for details. We will gladly send you a copy of the new "750" Fluid Power Cylinder Catalog. No obligation—WRITE TODAY.

MOUNTING STYLES



Hanna Engineering Works

1768 ELSTON AVENUE • CHICAGO 22, ILLINOIS

June 1954

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-281

281



There are lots of ways to
PIERCE METALS

... But here's
**Precision Multiple Piercing
at Lower Cost**

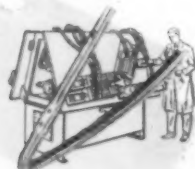
DANLY HYDRAULIC METALWORKING EQUIPMENT

Pierce metal faster, with greater accuracy and at less cost. In a single setup for multiple piercing . . . or riveting, punch extruding or trimming . . . you can reduce costly handling by combining operations into a single setup. Danly Hydraulic Metalworking Equipment is engineered to meet your specific needs. Exclusive all-hydraulic action permits smooth operation, minimizes break-through shock, automatically strips each station and simplifies fixturing. Find out more about high production multiple hole piercing in a single setup—write today for special Danly Hydraulic Metalworking Equipment Bulletin.

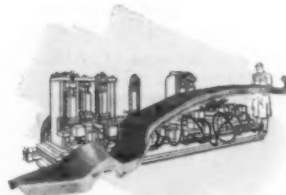


DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50, Illinois



One setup pierces seven irregular holes and trims this car door inner window frame.

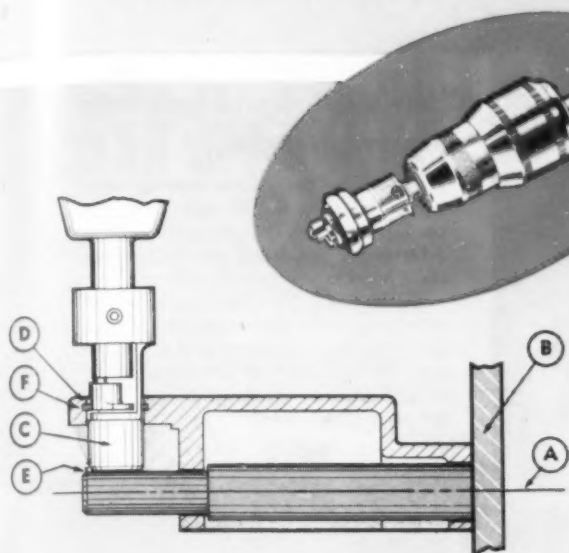


40 holes are pierced simultaneously in this automotive frame member on a Danly machine.



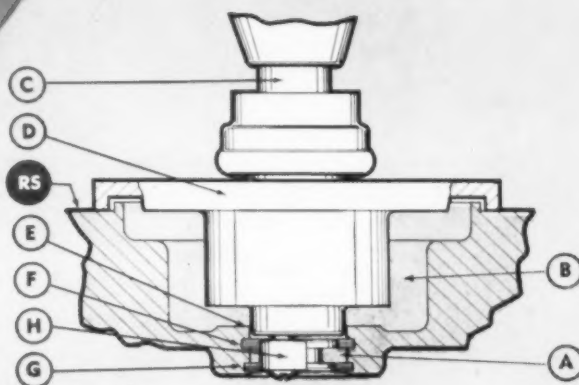
Irregular holes are pierced and accurately in this steel jet engine part.

Waldes Truarc grooving tool solves tough internal grooving problems, cuts costs in assembly-line production



Problem: Locating a Groove From Centerline of a Hole A.

- (a) Workpiece is fitted into plug on fixture plate B.
- (b) Bottom adaptor C on standard Waldes Truarc Grooving Tool is piloted into bore D and registers on side of plug E. Groove F is cut in exact location required.



Problem: Cutting Two Grooves—One Rectangular, One Beveled—Located In Bore A In Large Cavity B of Workpiece, and Located From Reference Surface RS.

- (a) Waldes Truarc Grooving Tool is fitted with elongated spindle assembly C and special bushing D which spans large cavity permitting tool to register on reference surface RS. Bushing also pilots tool into counter-bore at E.
- (b) Both grooves F and G are cut simultaneously with special form cutter H having both required contours.

AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in

housings with diameters from .250 to 5.00 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEMS TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE NOW FOR 20-PAGE MANUAL
CONTAINING FULL INFORMATION ON
WALDES TRUARC GROOVING TOOL



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TRUARC**
REG. U. S. PAT. OFF.
GROOVING TOOL

MADE BY THE MANUFACTURERS OF
WALDES TRUARC RETAINING RINGS.
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.

WALDES TRUARC GROOVING TOOL MANUFACTURED UNDER U. S. PAT. 2,411,426



Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on
the Waldes Truarc Grooving Tool.

Name _____

Title _____

Company _____

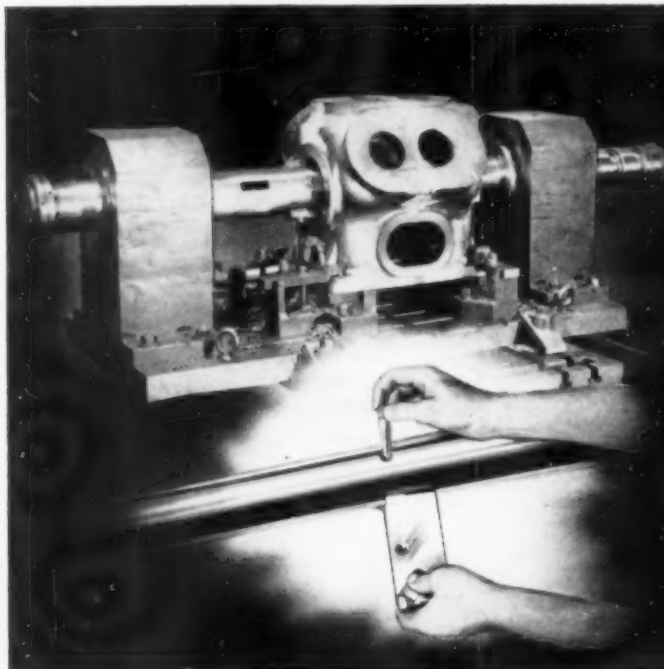
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City _____ Zone _____ State _____

TE-066



ROUTINE BORING: If there's a better way to do it, DAVIS will know it!

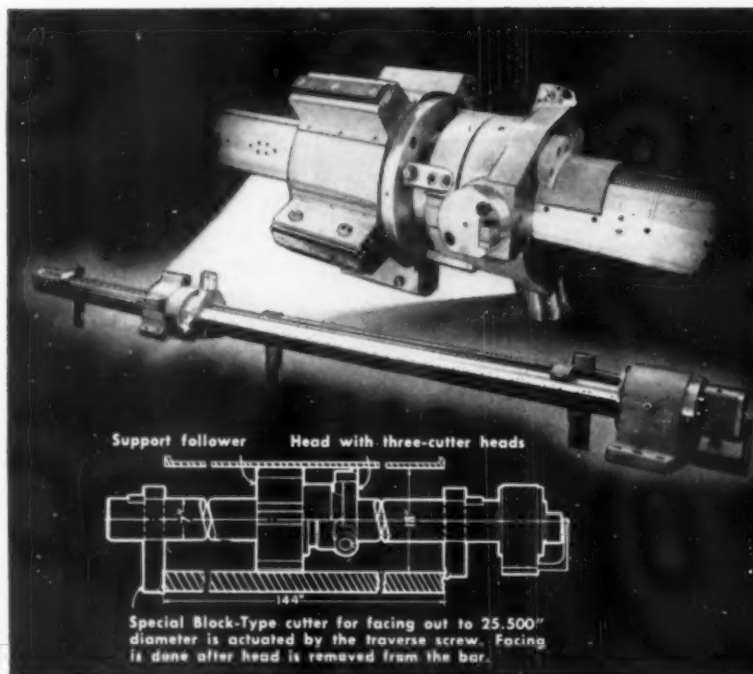


Here's how Davis tools help improve everyday jobs

Davis Block-Type cutters simplify ordinary float boring and reaming. Here, you see Davis Block-Type cutter, mounted in a Davis line bar, being used to bore the crank bores in an air conditioning housing.

Davis Block-Type cutters are exceptionally easy to insert or remove from the bar. Mere insertion or removal of the pin does the job. Without changing bar or setup, cutters can be changed for a sequence of operations.

EXTRAORDINARY BORING: If DAVIS can't bore it, it can't be done!



Traveling and feedout boring heads and blocks

Here's a special Davis three-cutter traveling boring head used to bore, face and chamfer. Mounted on a bar in a lathe, it is fed through the work by means of a traverse screw connected to the head. The support follower head, which assures a straight bored hole, slides through the bore while the bar rotates on needle bearings. Cross slide blocks face the two ends of the workpiece . . . are also used to cut phonographic grooves at the end.

The lathe spindle drives the bar, and work is supported in a special fixture. Gear box provides feed and rapid traverse in inches per revolution. Feed rates can be varied by changing gears.

What's your boring problem?

Davis makes a complete line of interchangeable block-type cutters, boring heads, boring bars, super-micrometer fly-cutter tools, L-type micrometer boring tools, special boring tools and accessories. Offers you a complete tooling service to solve any routine or extraordinary boring problems. Get the facts now. Write for the new Davis Catalog 304.



DAVIS
BORING TOOL DIVISION
OF GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN



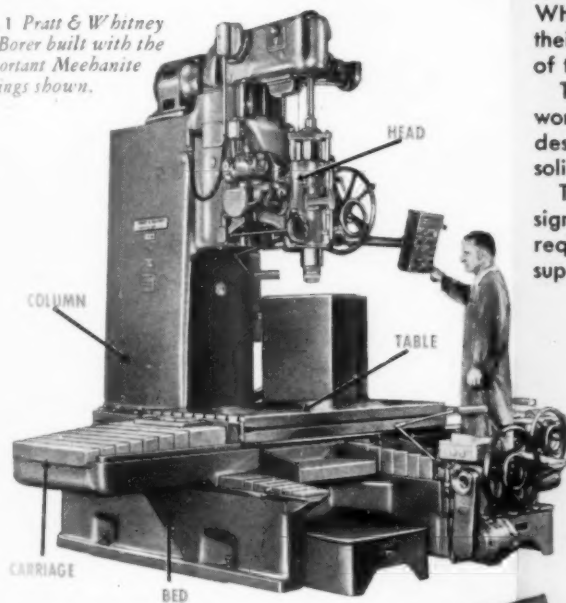
"hidden strength

to give

maximum support and stability"

Meehanite Castings Specified

FIG. 1 Pratt & Whitney Jig Borer built with the important Meehanite castings shown.



For other applications of Meehanite metal in the Machine Tool Industry, write for a copy of this bulletin. Among its 24 pages you will find many applications which may be of help to you.



MEEHANITE®

714 North Avenue
NEW ROCHELLE, N. Y.

MEEHANITE MEANS BETTER CASTINGS



FIG. 2 Complex Meehanite bed casting requires better properties, superior foundry control.

The headline above is a direct quotation. This is what Pratt & Whitney, Division Niles-Bement-Pond Company have to say about their reasons for specifying Meehanite castings for the components of the No. 4E Jig Borer shown in Fig. 1.

The importance of these castings in maintaining accuracy with work loads up to 5,000 pounds is obvious. Each must be properly designed to meet these demands—high strength, uniformity and solidity are essential.

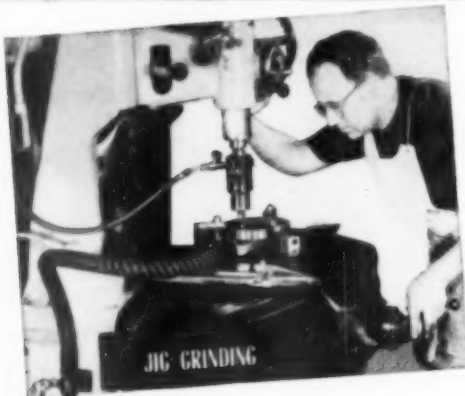
The bed casting shown in Fig. 2 illustrates the complexity of design required for this machine tool. Production of units of this type requires a high degree of control of all foundry process plus the superior engineering properties available in Meehanite castings.

MEEHANITE FOUNDRIES

American Brake Shoe Co.	Mahwah, New Jersey
The American Laundry Machinery Co.	Rochester, New York
Atlas Foundry Co.	Detroit, Michigan
Banner Iron Foundry	St. Louis, Mo.
Barnett Foundry & Machine Co.	Irrington and Dover, New Jersey
E. W. Bliss Co.	Hastings, Mich. and Toledo, O.
Builders Iron Foundry	Providence, Rhode Island
Compton Foundry	Compton, Calif.
Continental Gin Co.	Birmingham, Alabama
Crawford & Doherty Foundry Co.	Portland, Oregon
De Laval Steam Turbine Co.	Trenton, N. J.
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio and Grove City, Pa.
M. H. Detrick Co.	Newark, N. J. and Peoria, Ill.
Empire Pattern & Foundry Co.	Tulsa, Oklahoma
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Georgia Iron Works Co.	Augusta, Ga.
Greenlee Foundry Co.	Chicago, Illinois
The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Hardinge Company, Inc.	New York, New York
Hardinge Manufacturing Co.	York, Pennsylvania
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Koehring Co.	Milwaukee, Wis.
Lincoln Foundry Corp.	Los Angeles, California
London Concrete Machinery Co., Ltd. (Hartley Fdry.)	Brantford, Ontario
E. Long Ltd.	Orillia, Ontario
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Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
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Shenango-Penn Mold Co.	Dover, Ohio
Smith Industries, Inc.	Indianapolis, Ind.
Standard Foundry Co.	Worcester, Massachusetts
The Stearns-Roger Manufacturing Co.	Denver, Colorado
Traylor Engineering & Mfg. Co.	Allentown, Pennsylvania
Valley Iron Works, Inc.	St. Paul, Minnesota
Vulcan Foundry Co.	Oakland, Calif.
Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

"This advertisement sponsored by foundries listed above."

JIG GRINDING ACCURACY *guaranteed**



**INFINITE CONTROLLED
SPEEDS 30,000 TO
65,000 R. P. M.**

*Easily connect jig grinder
to jig borer or mill*

Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

*Other infinitely controlled
air driven spindle applications*

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3 1/2" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

"Dependably accurate to "tenths"



Vulcanaire
It's built by toolmakers for toolmakers

MAJOR VULCAN SERVICES

Engineering, Processing, Designing and Building, Special Tools . . . Dies . . . Special Machines . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size.

VULCAN TOOL CO.

7300 LORAIN AVENUE DAYTON 10, OHIO

USE READER SERVICE CARD; INDICATE A-6-286-1

GROBET CHATTERLESS COUNTERSINKS

They are terrifically popular because the six staggered cutting edges are scientifically designed to give a shearing cut and thus eliminate all chatter. Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.

Send
for
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Catalog



GROBET FILE CO. of AMERICA, INC.
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Plants—New York • Chicago • Montreal
USE READER SERVICE CARD; INDICATE A-6-286-2



**LOWER THE
BOOM ON COSTS
SET RIVETS
FAST**

2 at a time with the

Chicago
"214"

With every press on foot pedal Model 214 Chicago Double Rivet Setter automatically feeds, inserts and clinches *two* rivets. 14-inch throat accommodates large assemblies. Handles 9/64" diameter or smaller steel tubular rivets—lengths to 7/8". Quick Change Rotary Type Hoppers and Raceways permit a 5-minute changeover to rivets of different size. Adjustable anvils and riveting centers add to versatility. For help with fastening problem . . . send sample assembly (or a blue print) for free fastening analysis.



FREE CATALOG contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

Chicago Rivet & MACHINE CO.

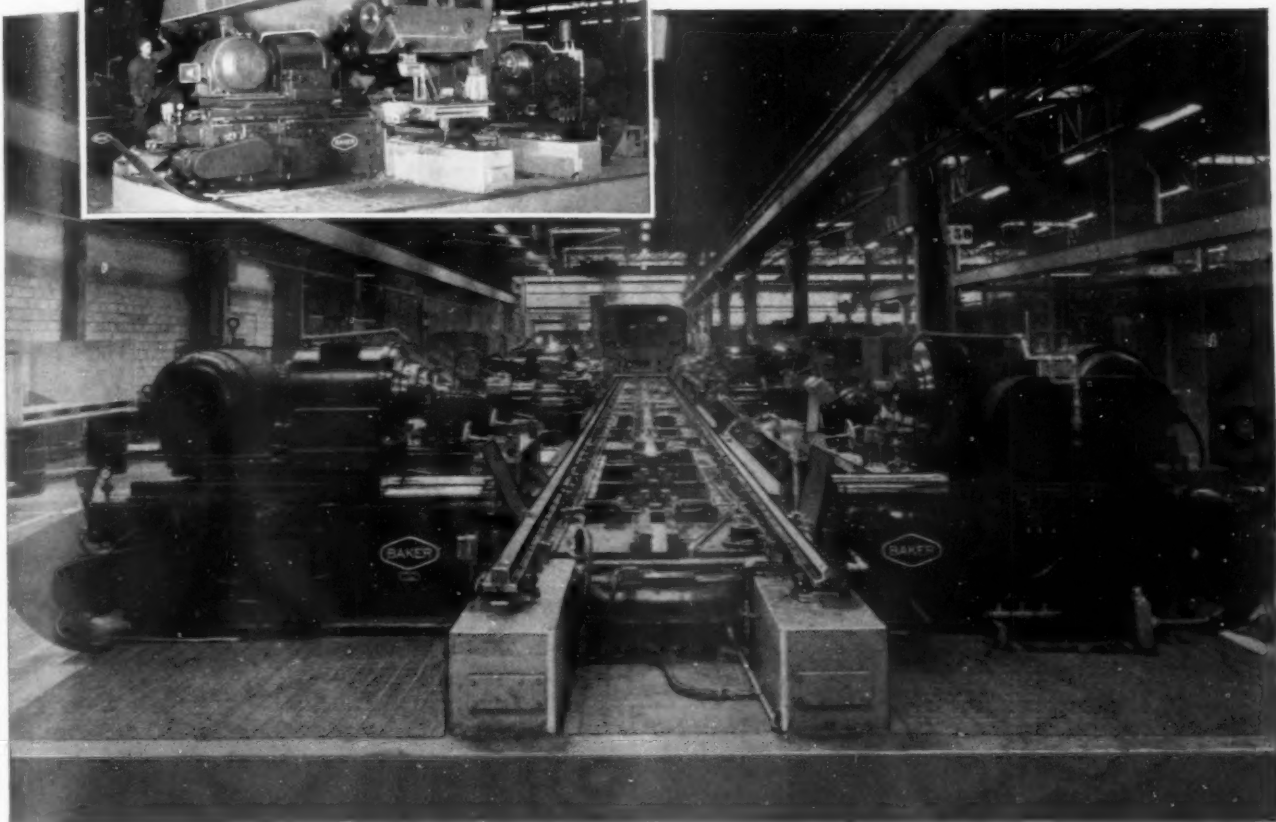
9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois
Branch Factory: Tyrone, Pa.

USE READER SERVICE CARD; INDICATE A-6-286-3

New BAKER Automatic

MACHINES

15,000 lb. TANK HULL
as it passes along
100 FOOT RAILS!



**OPERATIONS: DRILLING . . . TAPPING . . .
BORING . . . FACING on 102 holes . . .**

10 main bores Mounted on a specially-built floating concrete slab, this huge new Automatic Baker Transfer Machine accurately performs multiple drilling, tapping, boring and facing operations on

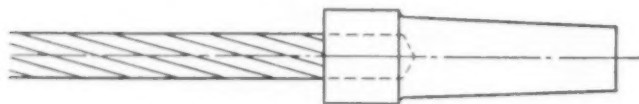
15,000 pound rough weldments 9 feet wide and 16 feet long. Savings achieved in production costs with a machine of this type are tremendous. Baker engineering know-how stands ready to solve your production problems . . . with cost cutting standard or special, single or multi-operation machines.

Write regarding your specific job problems . . .

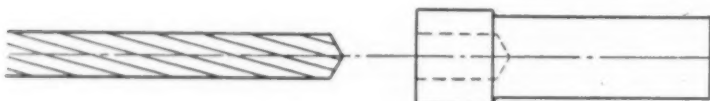
BAKER BROTHERS, INC. Toledo, Ohio
DRILLING...TAPPING...KEYSEATING and CONTOUR GRINDING MACHINES



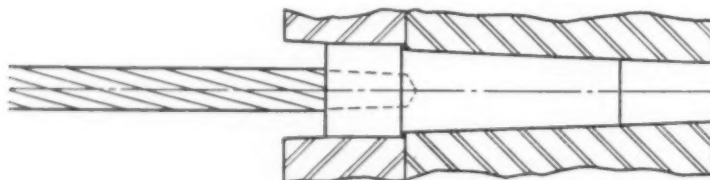
Cable Swaging... Clean, Quick, Economical



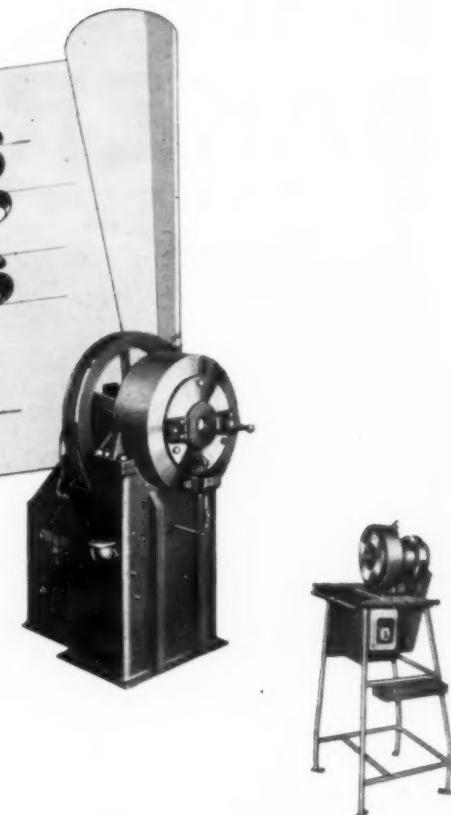
An electrical equipment manufacturer wanted a way to fasten terminals to cables—a way that would give perfect bonding—a way that was cleaner and faster than soldering or brazing.



Torrington's swaging experts showed him how to attach terminals to cables by one fast rotary swage.



Result: a clean, secure joint between cable and terminal, and accurate sizing of the plug end of the terminal at the same time.



Look at the savings that swaging can bring!

1. Savings in material and equipment—no solder, no brazing or dipping equipment needed.
2. Savings in labor—swaging can be done by unskilled personnel.
3. Savings in time—swaging is fast, clean and precise.

For more information on swaging as a method of bonding or reducing metals write for our informative booklet. It contains complete descriptions of the Torrington Rotary Swagers and may give you some ideas for a "swaging success story" in your own plant.

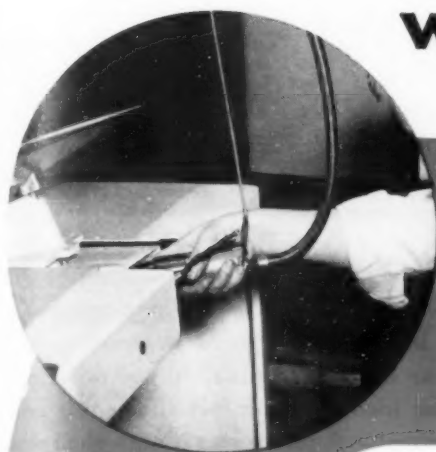


THE TORRINGTON COMPANY

Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON *ROTARY SWAGING* **MACHINES**

How AIRengineering can REDUCE YOUR FASTENING COSTS with IMPACTTOOLS



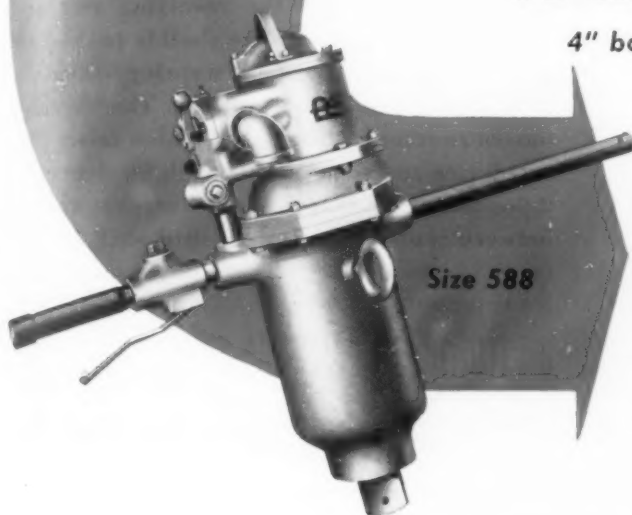
from the smallest
7/32" bolt capacity



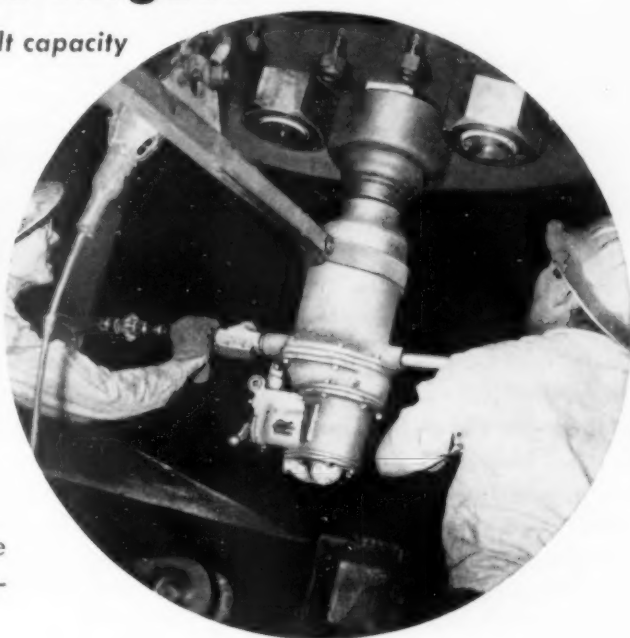
Size 500B

to the largest . . .

4" bolt capacity



Size 588



I-R Impacttools can save you up to 90% of the time required to perform nut running and bolting-up operations by hand methods.

Whether your operation calls for tightening or loosening nuts on tiny fraction-of-an-inch bolts or larger bolts up to four inches thread size, there's an I-R Impacttool to do the job faster and easier—and cut your fastening costs.

Call in an Ingersoll-Rand AIRengineer. He'll recommend the right I-R Impacttools for your fastening operations. I-R Impacttools—actually pay for themselves in days.

Ingersoll-Rand

8-37

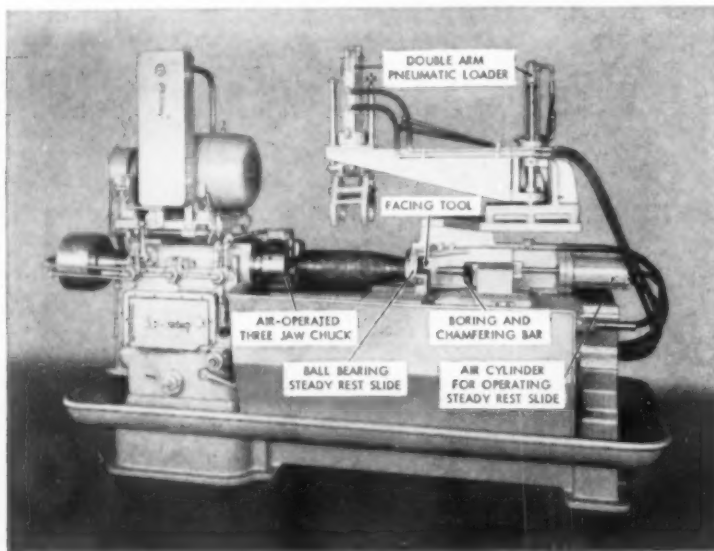
11 Broadway, New York 4, N. Y.

AIRengineering . . .

the modern way to faster production

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



MODEL LR Lo-swing LATHE, BORES, FACES AND CHAMFERS OPEN END OF 155mm SHELL AT LOW COST

PROBLEM: To rough and finish bore, face and chamfer thread diameter of 155mm shells automatically.

SOLUTION: The Model LR Automatic Lo-swing Lathe selected for this job was equipped with a pneumatically-operated, three-jaw chuck for holding and driving the shells from the boat tail end. The opposite end is supported with a cone-shaped, ball-bearing rest mounted in a special heavy duty fixture which replaces the standard tailstock. The revolving rest is built into a sliding member which is operated by a large air cylinder, controlled by a hand valve. The construction of the revolving rest is shown in the line illustration.

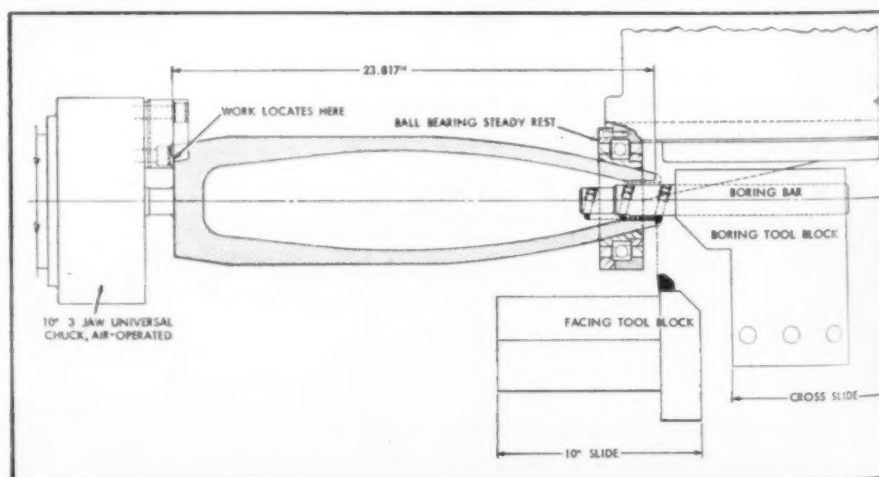
The lathe is equipped with two independently-operated front slides. The left hand slide carries a tool block and tool for facing

the open end of the shell to length and has a cross feed movement only. The right hand slide carries the combination rough and finish boring tools as well as the chamfer tool. This slide has both longitudinal and cross feed movements, providing tool relief on the return stroke of the boring bar. All tools operate simultaneously on a very fast machining cycle.

The problem of loading and unloading the heavy shells was solved with a double-arm, pneumatically-operated loader. A conveyor delivers rough shells to the rear of the machine. In position No. 1, one arm of the loader is directly above this conveyor and when lowered, picks up a rough shell while the other arm is clamped around the finished shell between centers. The operator then moves a control lever which retracts the revolving rest and also opens the chuck jaws. The shell is pushed clear of the chuck jaws by means of a spring loaded plunger located in the headstock spindle. The operator now moves another control valve, which raises the loading device and swings it through 90 degrees to No. 2 position. This movement delivers the rough shell between centers and the finished shell to a second conveyor, located at the front of the machine, which leads to the next operation.

Seneca Falls engineers are at your disposal to help solve your turning and handling problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N.Y.

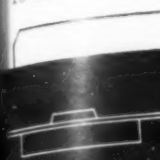


PRODUCTION COSTS ARE LOWER WITH Lo-swing



Turning

Tool tips on multiple-tool setup, turning SAE 1050 axles in as-forged condition. Best competitive steel: 6 to 7 axles per grind per set. VASCO SUPREME gives 15 axles per grind per set of tools on same job.



Boring

Turning bits, on axle hole of SAE 1060 car wheels, as forged, hardness BHN 255. Competitive steels gave 10 wheels per grind. VASCO SUPREME averages 40 wheels per grind on this assignment.



Milling

Ball end mills, on 30" diameter cams for carpet looms. Regular high speed steels produced 6 cams on first grind—gave 1 to 2 regrinds. VASCO SUPREME produces 14 cams on first grind, permits 3 regrinds before too small.



Threading

A unique job for a unique steel. Glass pulling roll 16 feet long, Rockwell "C" hardness 66-68, required highly-polished finished thread (28/inch) throughout length, with diameter tolerance of .0005". VASCO SUPREME tool cut thread 2605 feet long without regrinding, to tolerance of .0005"—one of the most remarkable performances ever recorded.

for

supreme
performance

in high speed steels

specify and use

VASCO SUPREME

These instances of SUPREME cutting efficiency, taken at random from current report files, typify the unparalleled service to industry provided by this extraordinary High Speed Steel. VASCO SUPREME will do work no other high speed steel will do. It is often used with cemented carbide tools—and at far less cost. And there are applications where *only* VASCO SUPREME's unique combination of strength and toughness will do the job as it should be done. Write us about your present needs.

VANADIUM-ALLOYS STEEL COMPANY

Manufacturers of First Quality Tool and Die Steels

Latrobe, Pennsylvania

COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.

TIPS FROM TAFT-PEIRCE ON:

How to Cut the Cost of Plain Fixed Gages

with TAFT-PEIRCE JOB-RATED GAGES

The *best* gage for most jobs provides the *best* combination of speed, wear-resistance, upkeep, and initial cost. Here are some comparisons that will help you keep costs to a minimum.

Plain Plugs



T-P Cylindrical Plug Gage. Furnished with "Go" and "Not Go" separately, or on opposite ends of handle. Progressive gage — with "Go" and "Not Go" on same end increases speed.



T-P Electrolyzed Plug Gage. With only a modest increase in initial cost, substantially longer wear life can be obtained with this exclusive surface treatment. Many users report up to 3 times longer gage life.



T-P Carbide, Norbide, Chromium Plated Gages. For exceptional resistance to abrasion or scratching and maximum wear life. Furnished in both standard and special sizes — from #8 machine screw size up.

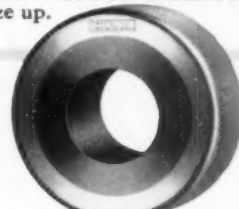
Plain Rings



T-P External Ring Gage. For reference purposes, setting air or other variable gages and accurate size control of parts.



T-P Chromium-Plated Ring. Lowers gaging costs on longer runs of highly abrasive materials or hardened steel. Provides up to 5 times more service.



T-P Norbide and Carbide Rings. For greatest wear-resistance. Available in Norbide and Tantalum or Tungsten Carbide. Brittleness requires careful handling.

Adjustable Snaps



T-P Plain Adjustable Snap Gages. Available with gaging pins, round or square buttons, and solid anvils in combination with buttons.



T-P Midget Snap Gages. Smaller in size and section, their light weight aids in gaging small or delicate parts. Maximum rigidity and stability are provided.

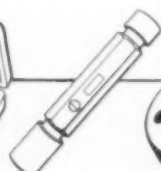


T-P Cemented Carbide or Norbide Snaps. For close tolerance work on abrasive materials. Gaging members tipped with Tungsten or Tantalum Carbide. Or with Norbide inserts, as shown.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



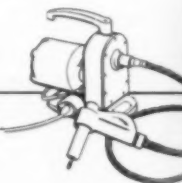
Gage Blocks



Plain Gages



Thread Gages



Rotochek

*T-P means
Top Precision*



THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

MEET THE CINCINNATI



Here is the newest member of the Cincinnati Hydroform family . . . a 19" machine which provides manufacturers with facilities for producing parts from blanks up to 19" in diameter, having a maximum drawn depth of 8". Material thickness of the formed part can range up to $\frac{3}{8}$ " cold rolled steel. A maximum forming cavity pressure of 15,000 psi provides the same high degree of formability that is available in the 12" and 26" Hydroform machines. Many intricate shapes can be formed in one operation, as the percentage of reduction in the draw is far greater than is obtainable by conventional practice.

The hydraulic power unit for the 19" Hydroform is pit mounted to provide unobstructed floor space

surrounding the machine. With this arrangement, the machine occupies an area only six feet square at floor level. Machine height above floor level is 11 $\frac{2}{3}$ feet.

Since the introduction of Hydroforming, this revolutionary deep drawing process has been widely accepted. Now, Hydroform machines are being employed on an extremely broad range of development work and on short run and quantity production.

Is your company fully informed of the many Hydroforming advantages? Let a Cincinnati Milling field engineer give you complete details. For general Hydroform data and specifications of the 8", 12", 19", 23", 26" and 32" Hydroform machines, write for your copy of Bulletin M-1759-3.



Hydroform

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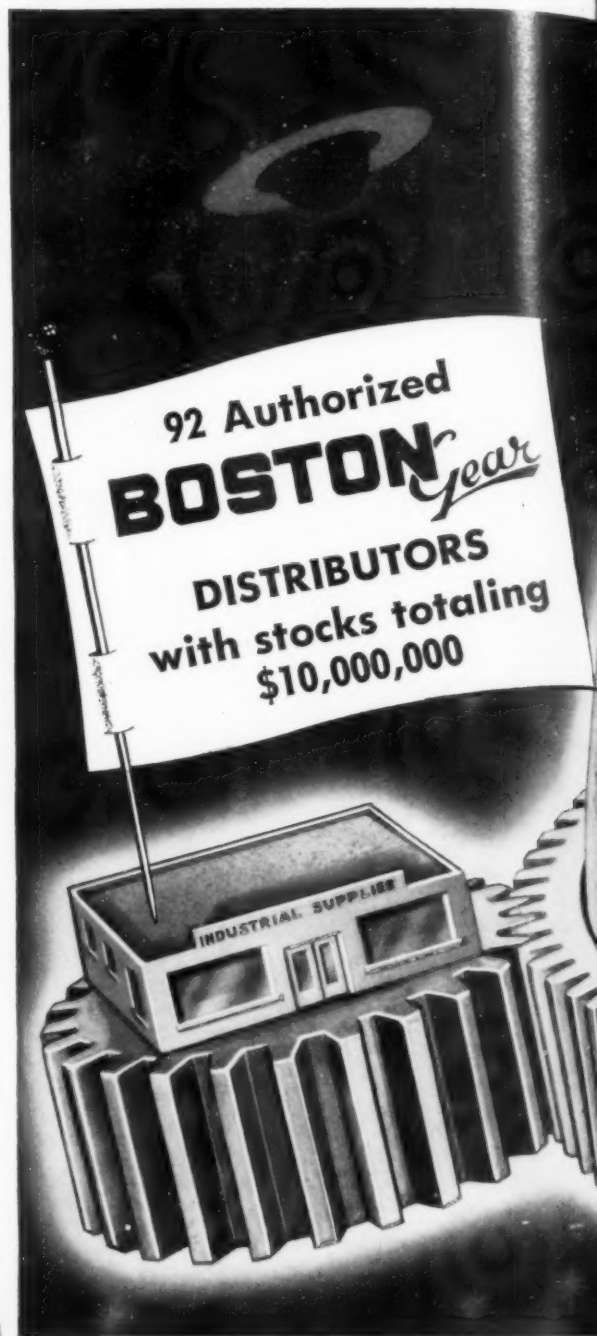
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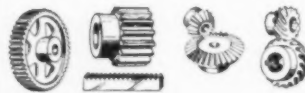
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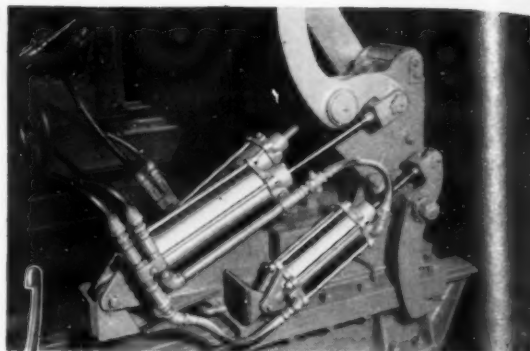
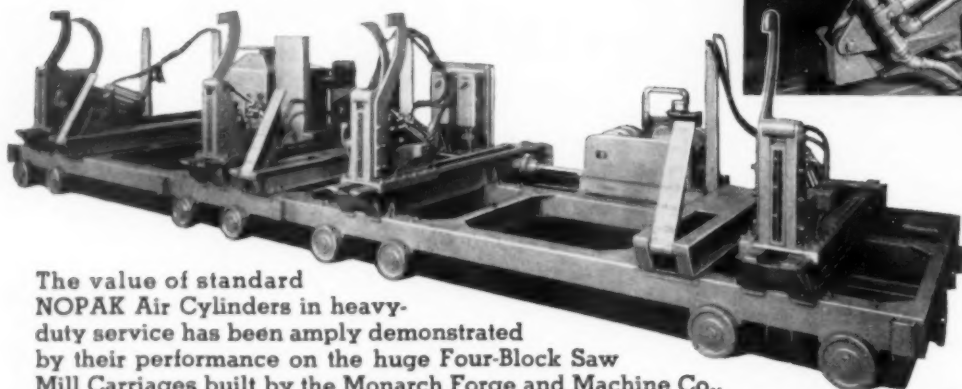
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"Double Hook Dogs"

are Powered by **NOPAK** Cylinders
on Monarch Four-Block Saw Mill Carriages



Close-up view of "Double Hook Dog" assembly shows how 3 NOPAK Model "E" Cylinders of different diameters and stroke lengths are employed to operate this mechanism. There are 4 of these "Double Hook Dogs" on each carriage.

The value of standard NOPAK Air Cylinders in heavy-duty service has been amply demonstrated by their performance on the huge Four-Block Saw Mill Carriages built by the Monarch Forge and Machine Co., Portland, Ore. Fourteen NOPAK Cylinders are used on each of these carriages which are extremely rugged in construction, and designed especially for the large western mills which utilize old growth fir and redwood logs. Monarch continues to specify NOPAK Cylinders because they really stand up under the rugged operating conditions to which they are subjected day after day, throughout the year.

Refer to Sweet's File for Product Designers or write for Bulletin SW-2.

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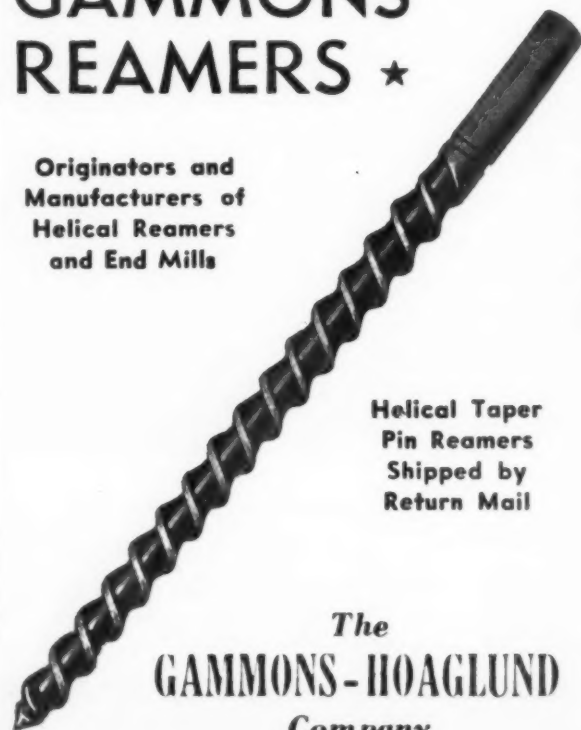
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Here is another Clearing first. Presses manufactured in advance of sale! Clearing inclinables in practically every capacity are now immediately available for shipment upon order. This time-saving manufacturing and sales policy has been undertaken by Clearing Machine Corporation to take the usual lag out of delivery.

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If you have been considering the purchase of an O.B.I. press, take advantage of this new production and delivery policy. Get in touch with Clearing by mail or telephone today.



New catalog gives complete size and tonnage specifications on Clearing O.B.I.'s. Just drop us a line. We'll mail it immediately at no obligation.



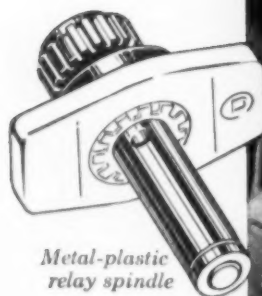
CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

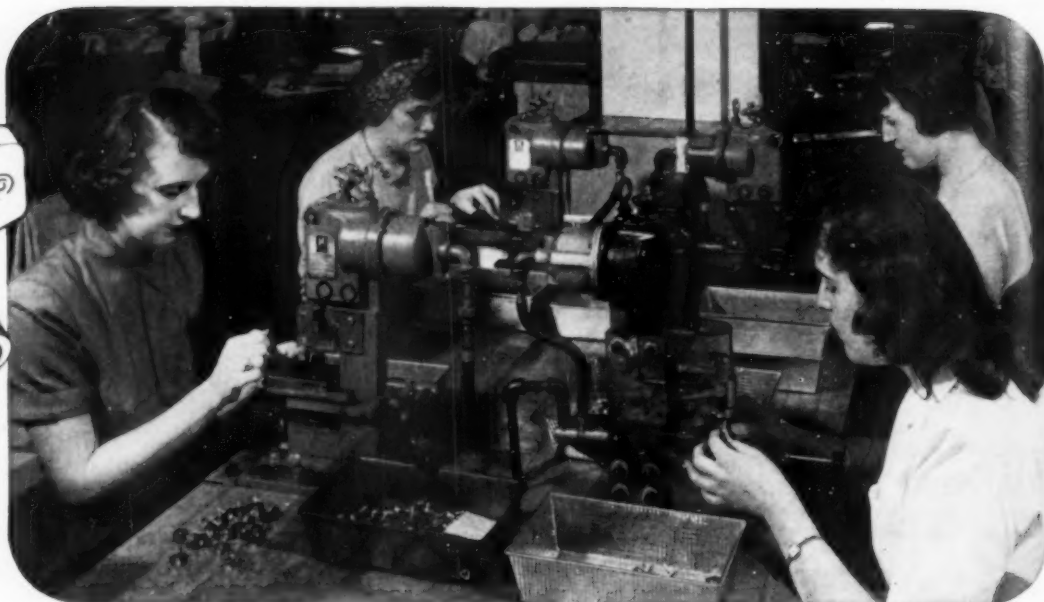
CLEARING MACHINE CORPORATION • 6462 West 65th Street, Chicago 33, Illinois • HAMILTON DIVISION, Hamilton, Ohio

Keller Compression Riveters

*give a squeeze
...not a wallop*



Metal-plastic
relay spindle



Reduce breakage when metal-plastic assemblies are forced into a pressure fit

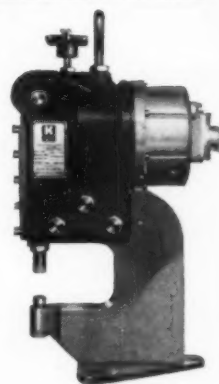
Here is the experience of a Keller customer in manufacturing electric relay spindles, consisting of brass posts and pressure-fitted plastic collars.

Attempts to assemble by hand were slow, inaccurate, and costly. Staking the parts together with solenoid-operated power equipment had to be abandoned because the sudden, sharp impact shattered too many plastic collars and made breakage costs excessive.

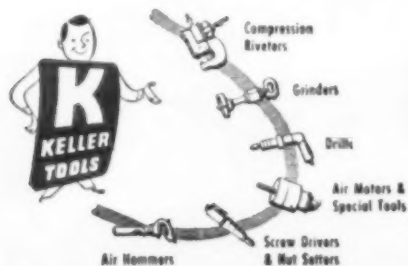
The problem was solved when a tool engineer fitted Keller Compres-

sion Riveters with special lever arms. When the arms descend, the parts get an air pressure squeeze—not a wallop—and are pressed together firmly with little or no shock. Air power exerts maximum force at the end of the stroke, where it is most needed; and pressure is not released until the arm completes its full stroke.

Perhaps this characteristic of applied air power would save breakage and reduce costs in some of your plant operations. Have you discussed it with the Keller application engineer near you?



Keller yoke-type Compression Riveters may be used for pressing, crimping, or forming, as well as riveting.



KELLER

Pneumatic Tools

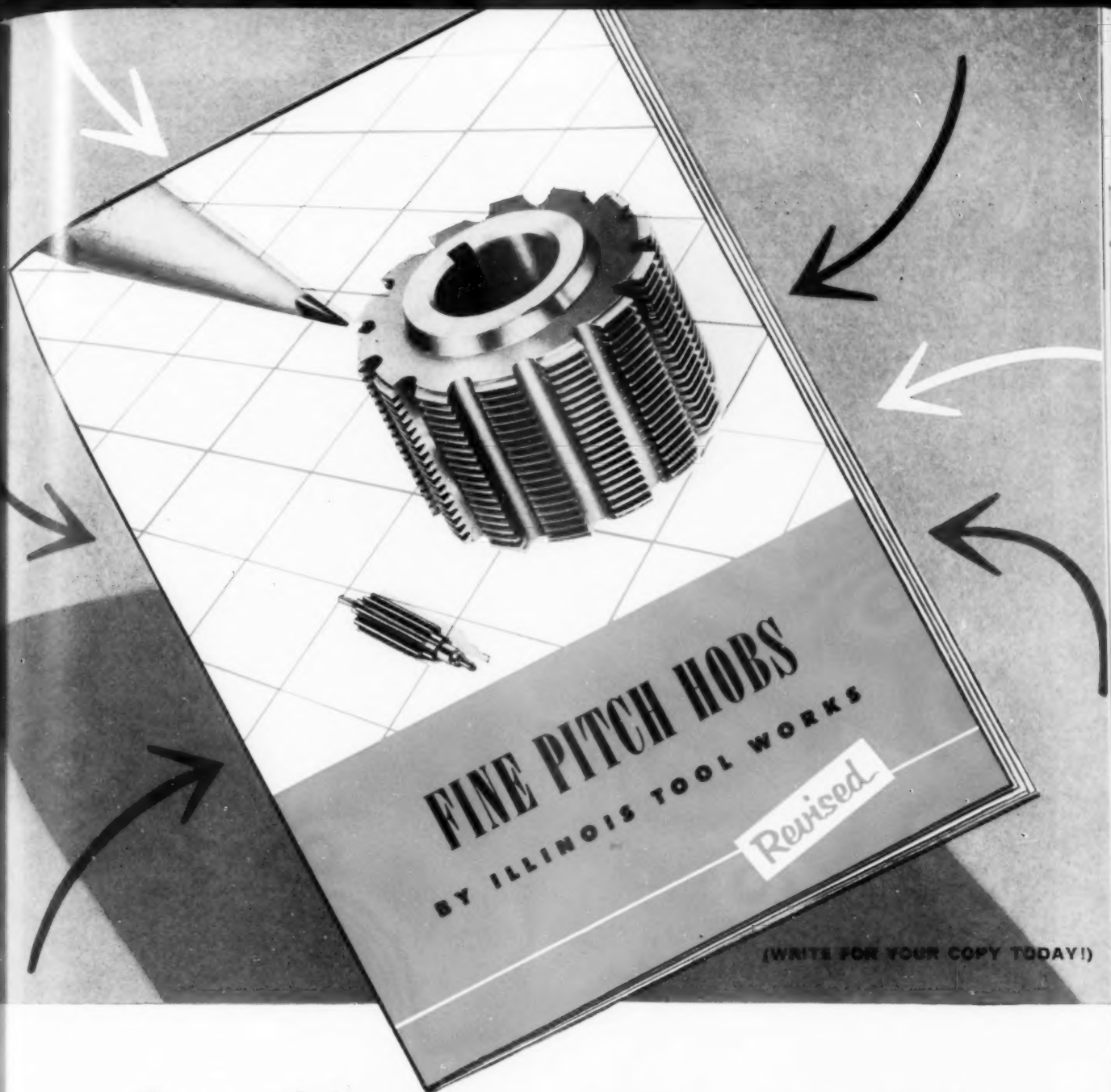
KELLER TOOL COMPANY, 1311 Fulton St., Grand Haven, Mich.



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Engineer



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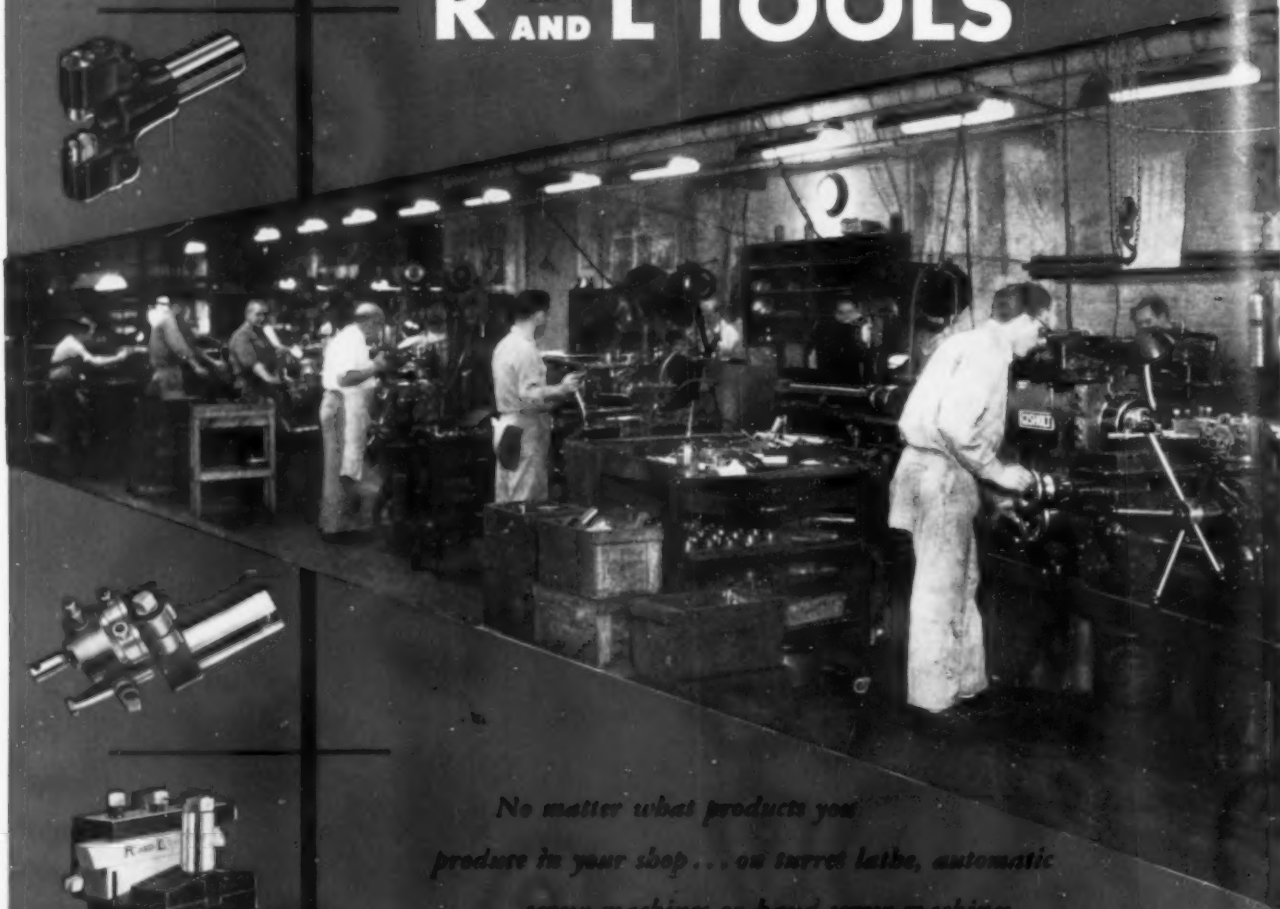
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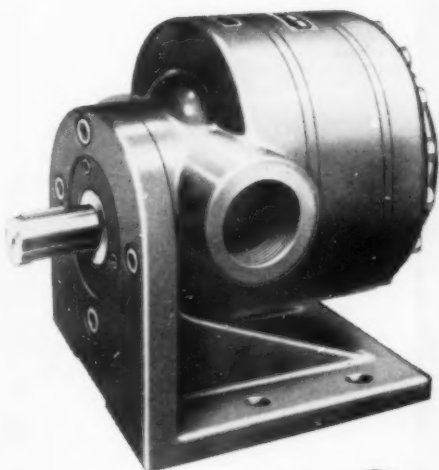
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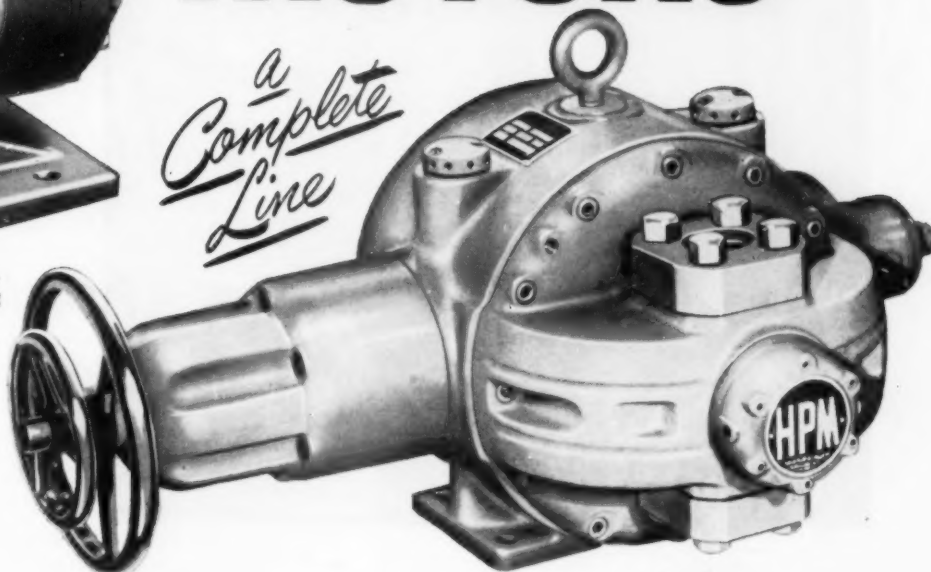
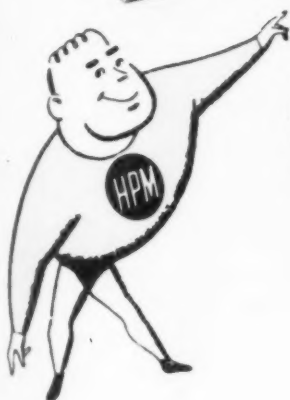
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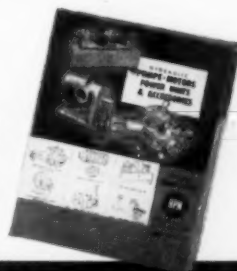
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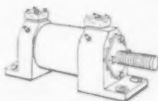
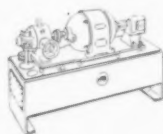


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Jarvis FLEXIBLE SHAFT MACHINES

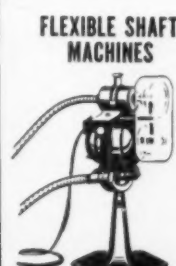
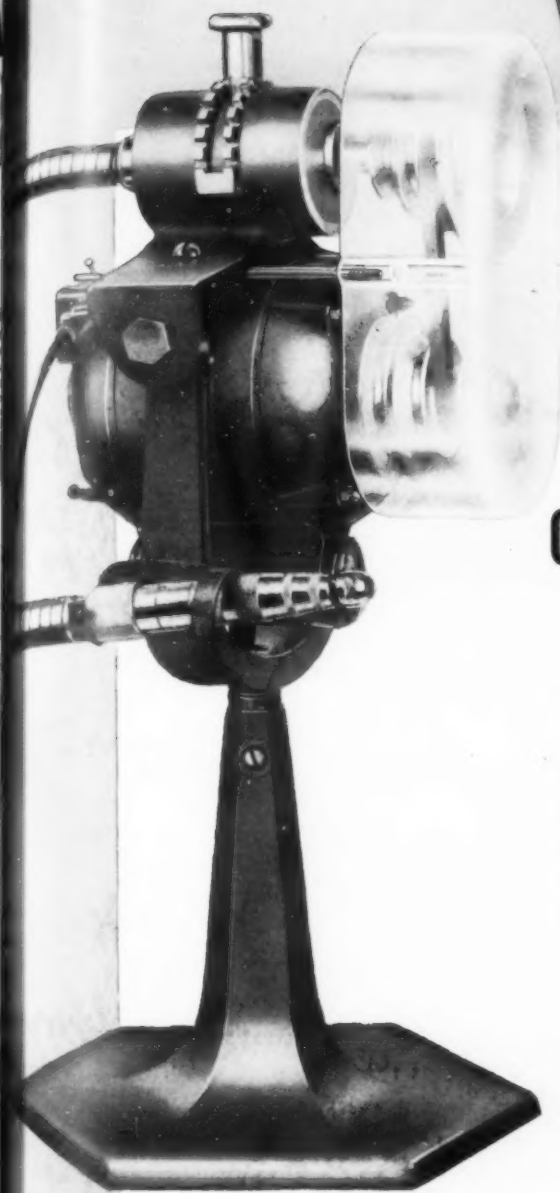
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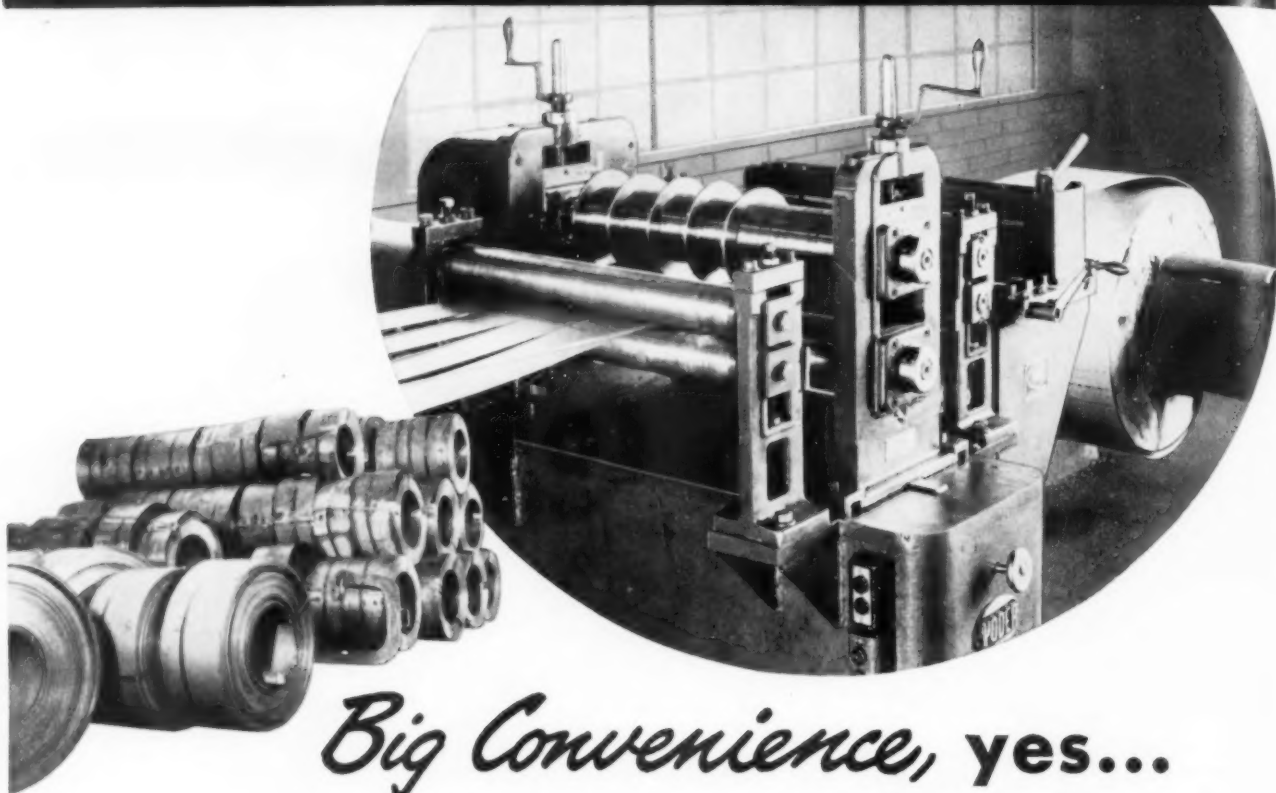
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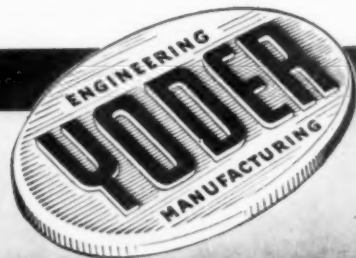
The Yoder Slitter Book is a treatise on the mechanics as well as the economics of slitter operation, with time studies, cost analyses, coil handling, scrap disposal, and other useful data. It's yours for the asking.

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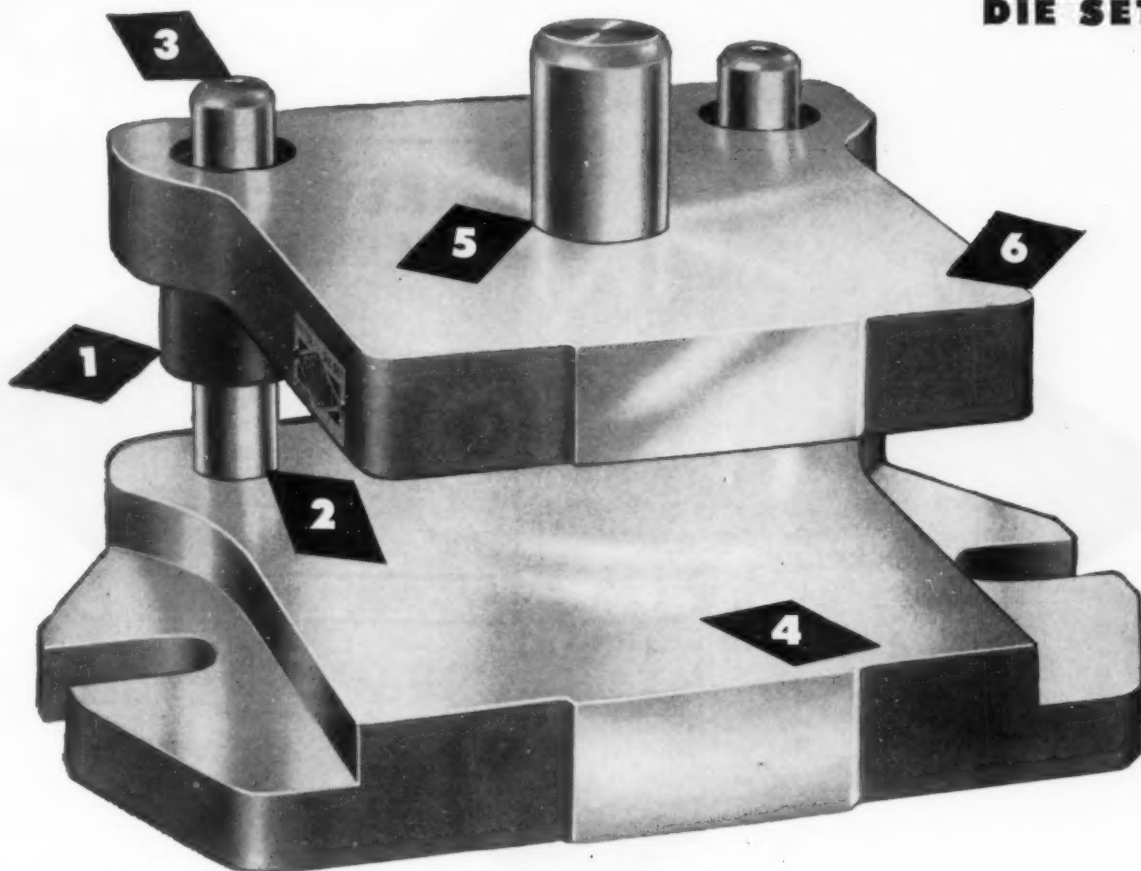
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June 1954

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SPDS2A

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For through holes where work is drilled and then re-handled and tapped.

BALL BEARING CONE-DRIVE

Designed for Ball Bearing High Speed Drill Press.

These Tappers may also be adapted for button or acorn die threading.

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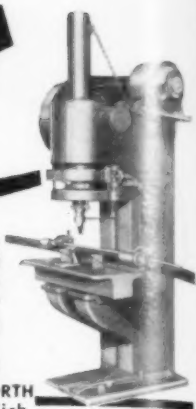
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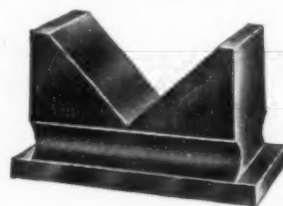
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Sturdily designed for hard-usage . . .
Accurately machined from close-grain iron . . . Ideal for drill presses, milling machines, shapers and planers. Will test round shafting for straightness.

Economically priced.



NO.	BASE	HEIGHT	THICK- NESS	ACROSS TOP	CAP.	NET PRICE
10	4 1/2" x 3"	2 5/8"	3"	3 1/2"	3 1/2" dia.	\$ 7.50 ea.
11	6 1/2" x 4"	4"	4"	5 1/2"	6" dia.	\$15.00 ea.

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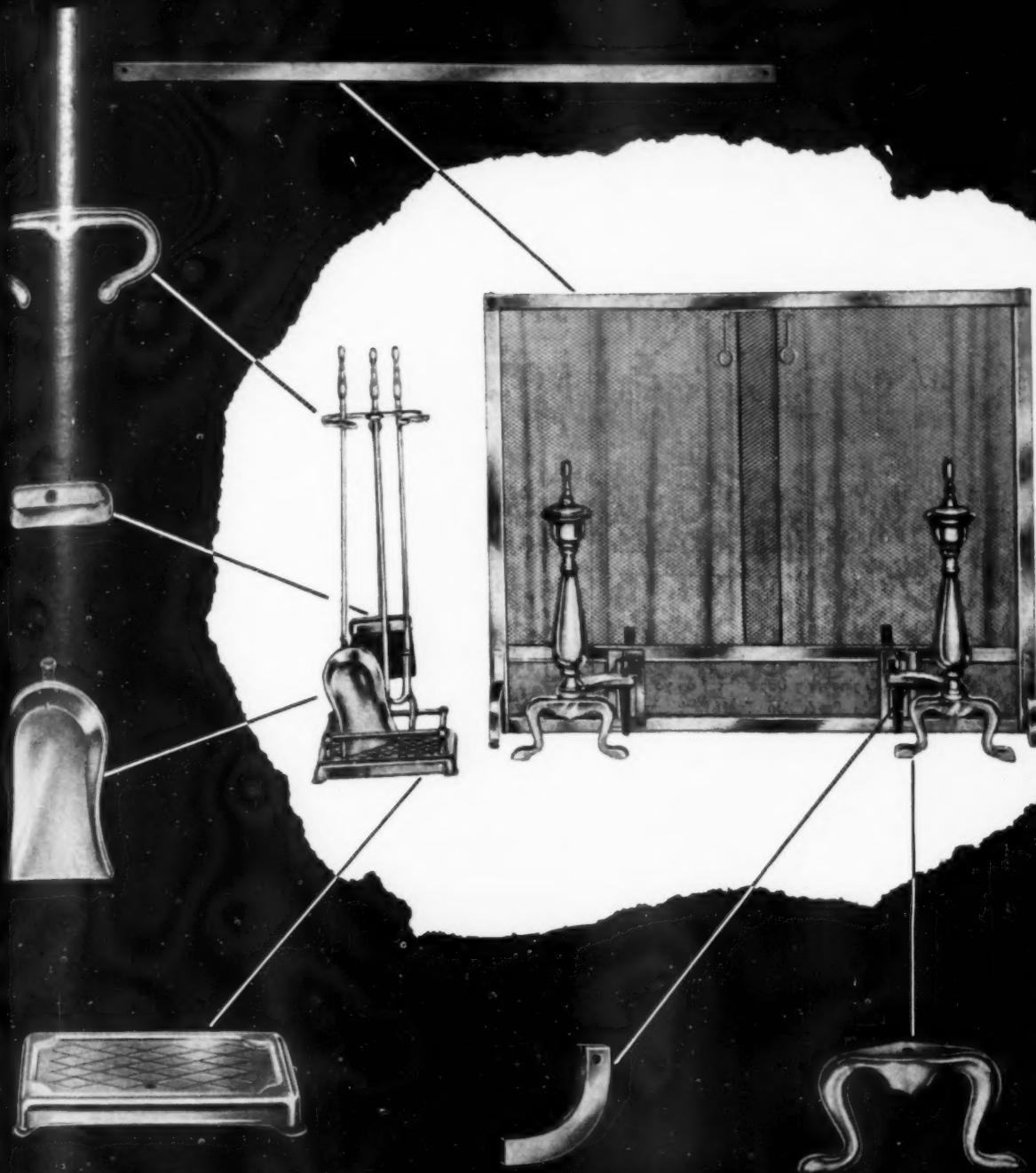
ACME TOOL COMPANY

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The Tool Engineer



FORMBRITE'S SUPERFINE grain structure enables Special Products Co. to buff this equipment in half the time necessary with ordinary brasses.

New kind of brass called "FORMBRITE" cuts finishing costs.

The bright, lustrous finish you see on this fireplace equipment — made of FORMBRITE® sheet metal — is the result of a simple color buff that took about half the time previously required. FORMBRITE's appearance after buffing speaks for itself.

FORMBRITE's superfine grain structure provides a surface far superior to ordinary drawing brasses. In every case, it's meant important savings in finishing costs...and improved product quality.

FORMBRITE is readily formed, drawn or embossed... results in products that are harder, stronger, "springier"

and more scratch-resistant.

But don't take our word for it. Read what others say about this specially processed drawing brass:

Niagara Searchlight Corp. — "Cuts polishing and buffing time on flashlight end caps 50%... plating and general quality are improved, too."

Aeroplane Tackle Mfg. Co. — "We cut polishing costs over 25%... on several stamped products we get the required finish by a simple tumbling before lacquering or plating."

Sheaffer Pen Co. — "Savings in polishing costs are as high as 50%. Formbrite

gives us a longer-lasting product."

Yet with all the plus values FORMBRITE offers over conventional brasses *it costs no more.* You can do it better, faster and cheaper with FORMBRITE. Want a sample? More information? Write: *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* *Reg. U. S. Pat. Off. 5483

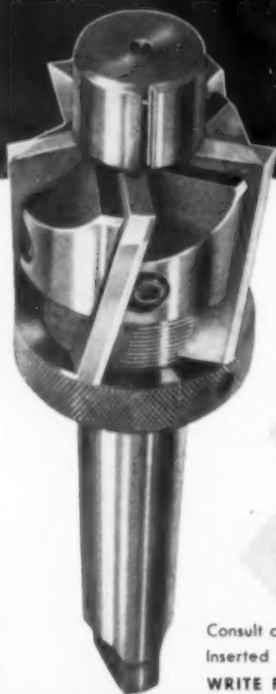
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an ANACONDA® product

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Interchangeable Pilots

Constant Chip Space
Throughout Life of Blades

Standard Sizes 1 1/4 to 4
Standard with Straight or
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H. S. S.—Carbide Tipped
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METAL PLAN FILE

MAYLINE

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Trade Mark

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THE RIGHT TOOL FOR A
SMALL END MILL JOB IS A—
**MICRO MINIATURE
END MILL**

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Catalog

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TODAY APPEARING IN THIS ISSUE OF THE TOOL
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CARD ON PAGE 141.

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BUILT FOR SPECIFIC PRODUCTION JOBS



- Single or Multiple Head Operation
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- Non-reversing Motor Drives

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- Other Head Units Available
- And Many Other, Worthwhile Features

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KAUFMAN MANUFACTURING COMPANY

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The Tool Engineer

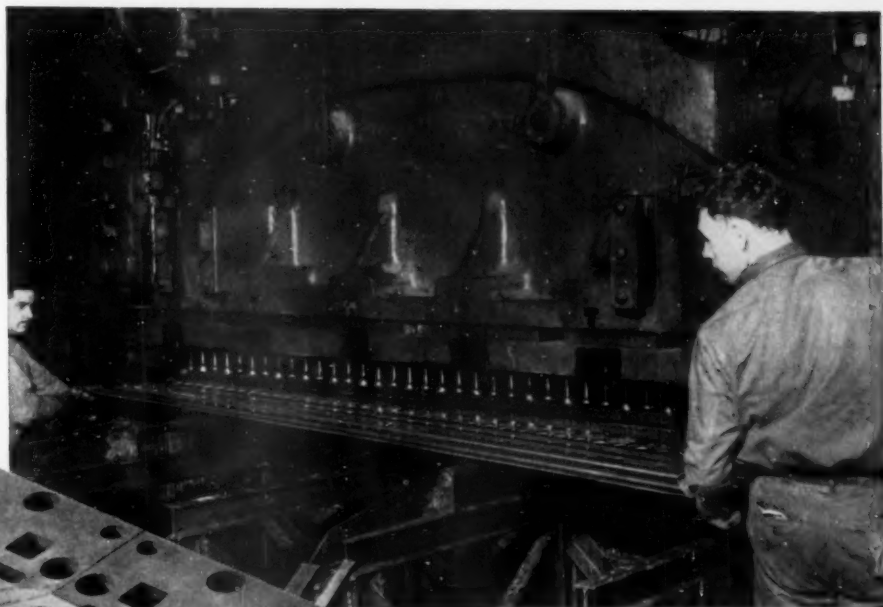
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

For a complete Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation

BETHLEHEM
STEEL

Dies of A-H5 Give Good Service in Turning Out Landing Mats



A-H5 dies, operating in this 700-ton press, blank sheet steel in manufacture of landing mats at J. S. Thorn Manufacturing Co., Philadelphia.

Blanking dies made of A-H5 get a real workout at the J. S. Thorn Manufacturing Co. plant, Philadelphia, as they bite into .135 gage, 29 in. x 144 in. hot-rolled sheet steel.

The dies, hardened to Rockwell C-58-60, are used in the manufacture of air-field landing mats. They operate in a 700-ton press, and produce about 120,000 pieces between grinds. About 0.010 in. to 0.015 in. is removed per grind. The dies are giving good performance because of their resistance to wear and shock. In addition, A-H5 offers the advantages of low distortion, and ease of machinability and heat treatment.

A-H5 is our 5-pet-chrome air-hardening tool steel. It's an easy tool steel to machine, too, as it can be annealed to 212 Brinell.

Typical Analysis

Carbon	1.00	Molybdenum	1.10
Manganese	0.60	Vanadium	0.25
Chromium	5.25		

A-H5 is an economical steel for dies, punches, and forming and blanking tools. It is well liked wherever safe hardening, low distortion and increased resistance to wear are required. Why not give it a trial? Your nearest Bethlehem tool-steel distributor can supply you promptly.

This closeup shows intricate arrangement of dies. Approximately 120,000 pieces are blanked between grinds.



BETHLEHEM TOOL STEEL ENGINEER SAYS:

Avoid Premature Failure—Don't Make Shock Tools Too Hard

As a rule, shock-resisting tool steels perform best when they are hardened to Rockwell C-55/C-60. At such a range, there's a good compromise provided between toughness and resistance to wear. When premature failure occurs in these grades, it can usually be traced to excessively high hardness.

But rather than harden shock-resisting steels to Rockwell C-59 or higher, when such hardnesses are required, it would

be better to select a carbon tool steel.

When greater wear-resistance is required, the chrome-tungsten grades of shock-resisting tool steel may be carburized to provide a hard case and a shock-resisting core. The carburized case used for this type of shock-resisting steel should be only 0.010 deep. This method can be used to good advantage when you are manufacturing such items as reamers, swaging dies and master hobs.

Webber Gage Company Announces

The Development and Production

of the world's most
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of measurement

Webber "Laboratory Master" GAGE BLOCKS

Webber "Laboratory Master" Gage Blocks set a completely new standard of accuracy for dimensional control of precision manufacturing. They are the result of many years of scientific research and experimentation. They are the closest approach to absolute perfection that has ever been attained.

Webber "Laboratory Master" Gage Blocks are not a dream, but a reality. They are in production now, and orders are being accepted for delivery in rotation. They are guaranteed to be within 0.000,001" in parallelism and flatness across width... 0.000,002" along length, and within $\pm 0.000,002$ " in size.

We repeat this statement—Accurate within 0.000,001" in parallelism and flatness across width... 0.000,002" along length, and within $\pm 0.000,002$ " in size.

This is the nearest approach to absolute dimensional perfection ever attained. The production benefits of this almost incredible accuracy are now available to industry at a cost which is extremely modest.

The achievement of what, to all intents and purposes is absolute perfection, is due to three things...

(1) The human skill and "know-how" which comes only from many years of experience.

(2) Croblox (Chrome Carbide), the material used, has no equal for durability, resistance to corrosion and fine grain structure. The "mirror" finish imparted to Croblox gaging surfaces will not accept oxidation, corrosion or even a microscopic film, any of which would impair the fantastic accuracy of the gages. Surface finish is so smooth that it can be checked only by the Interference Microscope.

(3) The final checking of each gage block is performed in

the Webber laboratory, one of the few of its kind. This laboratory is maintained at a constant temperature of 68 degrees 365 days in the year. The laboratory employs the new Zeiss Opton Interferometer ("interference" method), one of the most accurate measuring instruments known.

Webber "Laboratory Master" Gage Blocks are intended to be used where constant temperature is maintained in room or laboratory. Under such condition they are to be accepted without question as the final word in accuracy.

The complete Webber "Laboratory Master" Gage Block Set—82 blocks, fitted in ebonized hardwood chest, is priced **\$1850.00**

Each set bears its own individual serial number and is accompanied by Notarized Affidavit certifying the accuracy of the 82 blocks comprising the set. The readings are guaranteed accurate within plus or minus one millionth of an inch.

Due to the extreme care and precision required during the production processes, together with the many phases of checking and rechecking during final calibration, from 60 to 90 days are required for delivery.

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Webber GAGE COMPANY

12908 Triskett Road • Cleveland 11, Ohio



Largest Exclusive Manufacturers of Precision Gage Blocks

With the Brush SURFINDICATOR,* surface roughness measurements can be made on the production line.



Can this simple check

HELP YOU REDUCE MACHINING COSTS?



The smoother the finish, the higher the machining cost - yet in many plants parts are overfinished because of the lack of proper gaging equipment. For example, if a surface roughness of 125 microinches is specified, and you are finishing to 32 microinches, your machining costs may be as much as twice that actually required for the job.

This expensive overfinishing can be eliminated with the new Brush SURFINDICATOR. It is a practical shop instrument that permits fast accurate measurement of surface roughness on the production line. It is simple to operate, portable, and can save its cost a hundred times over.

Write now for the booklet "Surface Finish Control", which explains how proper surface control can reduce machining costs, increase plant capacity, and improve product performance. Brush Electronics Company, Dept. BB-6, 3405 Perkins Avenue, Cleveland 14, Ohio.

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MAGNETIC RECORDING EQUIPMENT
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COMPANY

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

The SURFINDICATOR weighs only 15 pounds, can be set up anywhere in the plant where 115 volts a.c. is available.

*Trade Mark

Don't throw away that back-up pad!

Just replace the leather!
It's the new Armour Back-Up Pad
with re-usable plates!

Are you throwing away your back-up assemblies—metal parts and all—when just the pad wears out? You can save that expense with the new Armour Back-Up Pad. It's designed so you can detach the steel plates and use them over and over again! The pad will last longer, too, because it's a two-ply construction of the finest leathers, tanned and curried for resistance. And when the leather finally does wear down, you can save money by cutting the Armour pad into a smaller size—it's as good as new!



Another money-saving feature of the new Armour Back-Up Pad is that it's tailored at the factory to save you "breaking in" time. You can even order the flexibility you want—hard, medium or soft! And to guarantee perfect flexibility, your Armour Back-Up Pad receives four precision-balance tests at high speeds. So you can be sure that your pad absorbs shock, cuts down vibration and provides the disc with smooth, safe sanding action. Let your workmen test this precision-balance pad once—and they'll request Armour Back-Up Pads always for higher production and less operating fatigue!

Use these new pads with Armour Resin Fibre Discs!

Actual production tests have proved that resin-bond discs have two big advantages over glue-bond products—resistance to heat and resistance to moisture. So save money in severe grinding operations and edge-wear grinding jobs—choose Armour Resin Fibre Discs! And for belts, rolls, sheets, any abrasive you need, call on Armour today!

Learn more about Armour's Precision Abrasives!

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CARMET[®]

The Allegheny Ludlum line of Carmet Carbide Tools is complete—every style, size and grade you may need for any cutting job in the shop. If you make your own tools, a full line of blanks is available, too—as well as all necessary sizes of A-L Shank Steel. Extensive stocks of Carmet standard tools and blanks are carried in Distributor's warehouses coast to coast, and special tools are available to order.

• Just remember, for best performance on any application, use Carmet! Allegheny Ludlum Steel Corporation, Carmet Division, Wanda and Jarvis Avenues, Detroit 20, Michigan.

For complete MODERN Tooling, call
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Which will it be—?

Price
Cost

As you well know, *price* of new equipment is only the beginning. Actual production savings determine real equipment *cost*.

From this realistic *cost* standpoint you can't beat Erickson collet chucks. Here's why:

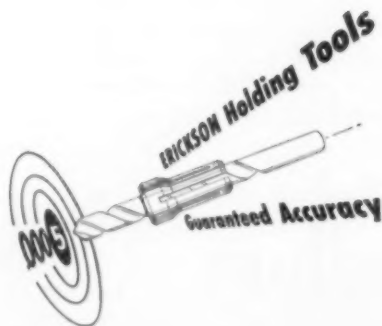
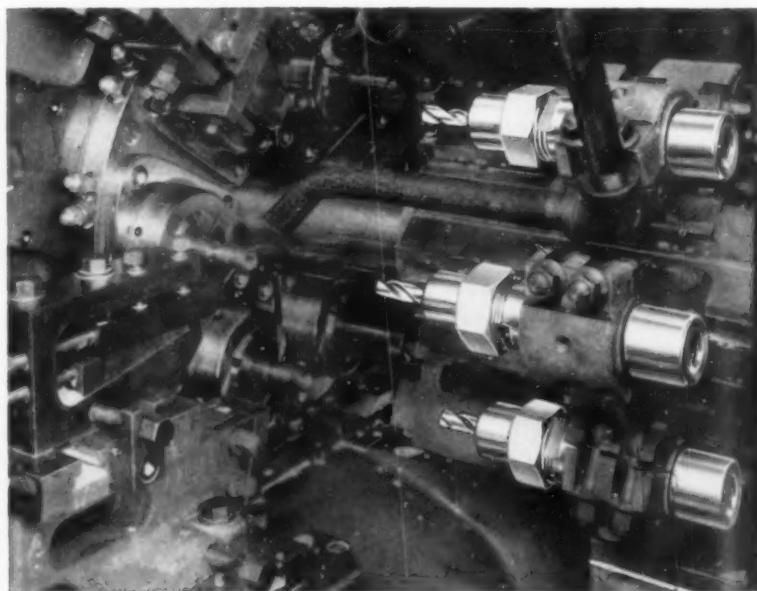
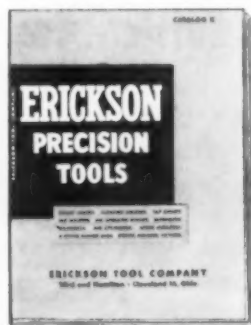
Guaranteed accuracy of .0005" and superior gripping power of Erickson collet chucks assure proper drill alignment. Drills then cut evenly on both cutting lips permitting faster machine feeds and proper speeds . . . give more holes per grind.

What's more, ease of operation greatly reduces set-up time and since Erickson chucks can grip on the flutes, you can stub your drills . . . extend tool life . . . maintain accuracy.

Send for new Catalog K today! It gives the complete Erickson story. You'll find many interesting applications for all Erickson holding tools.

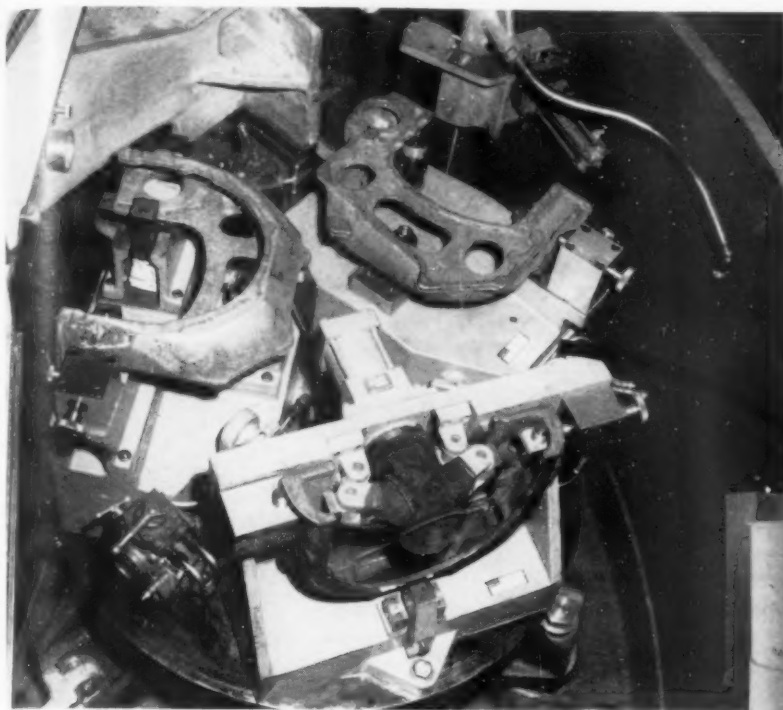
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ERICKSON TOOL COMPANY 2303 Hamilton Ave., Cleveland 14, Ohio



COLLET CHUCKS • FLOATING HOLDERS
TAP CHUCKS • TAP HOLDERS • AIR-OPERATED
CHUCKS • EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

MULTI-STATION FIXTURING GIVES Continuous Low Cost Production



**One Fly Wheel Housing
—Ground on Three Surfaces**

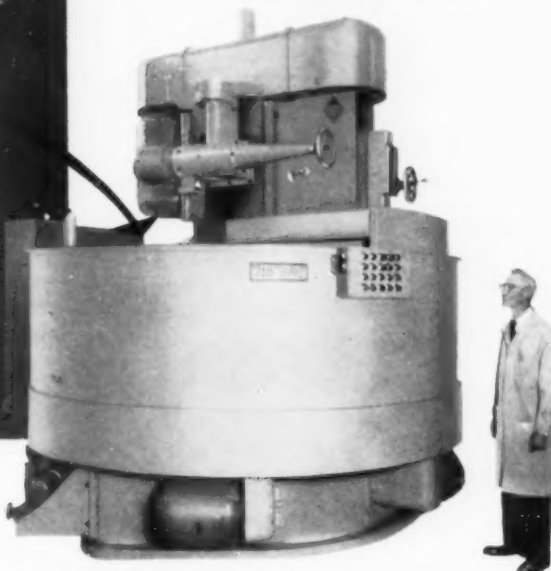
—EVERY 72 SECONDS!

That's the production achievement of this Model 718 Besly-Bowen Radial Head Face Grinder, used to grind automotive fly wheel housings. Accuracy is also noteworthy. With approximately 3/32-in. of stock removed from each face, work is held parallel within .003, flat within .005 and to size within .010.

Multi-station grinding is one important reason for this performance. Two stations, each consisting of a 40-in. diameter rotary table holding three pneumatic clamping fixtures, are used with this grinder. At each of the fixtures, a different face of the fly wheel housing is presented to the grinding disc; this results in a completely ground housing with each cycle of the grinder. While grinding automatically proceeds at one station, the operator is free to unload, clean and reload housings at a second rotary table. Grinding is continuous at alternate stations with no time lost for loading and unloading. The fly wheel housings are ground accurately and quickly without distortion because of the controlled progressive grinding cycle.

Where high volume and precision in a sequence of grinding operations is your problem, it will pay to investigate the Besly-Bowen line. Write for a full description.

on this *New*
**BESLY-BOWEN
GRINDER**



**The 718 Besly-Bowen — a new
kind of surface grinder with
these features:**

- Multi-station Fixturing Permits Continuous Grinding of Sequence Operations—No Interference Between Loading and Grinding
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- Automatic Size Control
- Fixturing Flexibility
- Single, Massive Slow-Moving Bearing Insures Accuracy with Four-Way Compound Movement . . . Up — Down — Back and Forth
- A Wet Grinding System—Free from Flying Water and Spray

**Write for a Full Description of This
Type of Grinder**
Available in four models from 5-100 H.P.



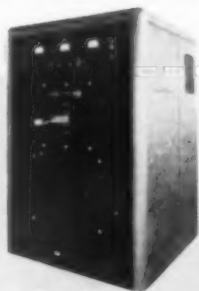
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soldering, hardening, annealing, stress relieving, hot forming, forging or shrink fitting requirements.

We can't tell you much about the manufacturing processes at the L. A. Young plant (due to security restrictions) . . . but we can tell you about the many rugged construction features of this equipment . . . features which make it so dependable that the L. A. Young organization selected Lindberg Induction Heating Units for their important Department of Defense work. These points of design and construction will minimize costly breakdowns and aggravating work stoppages:

Filament voltage regulation transformers keep tube filament voltages at proper values regardless of line fluctuations. The end result . . . longer tube life.

Checklites . . . A system of indicating lamps instantly reveals any abnormal operating conditions . . . simplifies servicing.

Work coil burn-out protection . . . An electrical interlock system makes it impossible to turn on power when cooling water is not flowing.

Long-life industrial tubes feature shortened internal structure . . . Kovar metal-to-glass Seals . . . heavy walled anodes.

Sealed tank capacitors are hermetically sealed against dirt and dust . . . require no servicing or refilling.

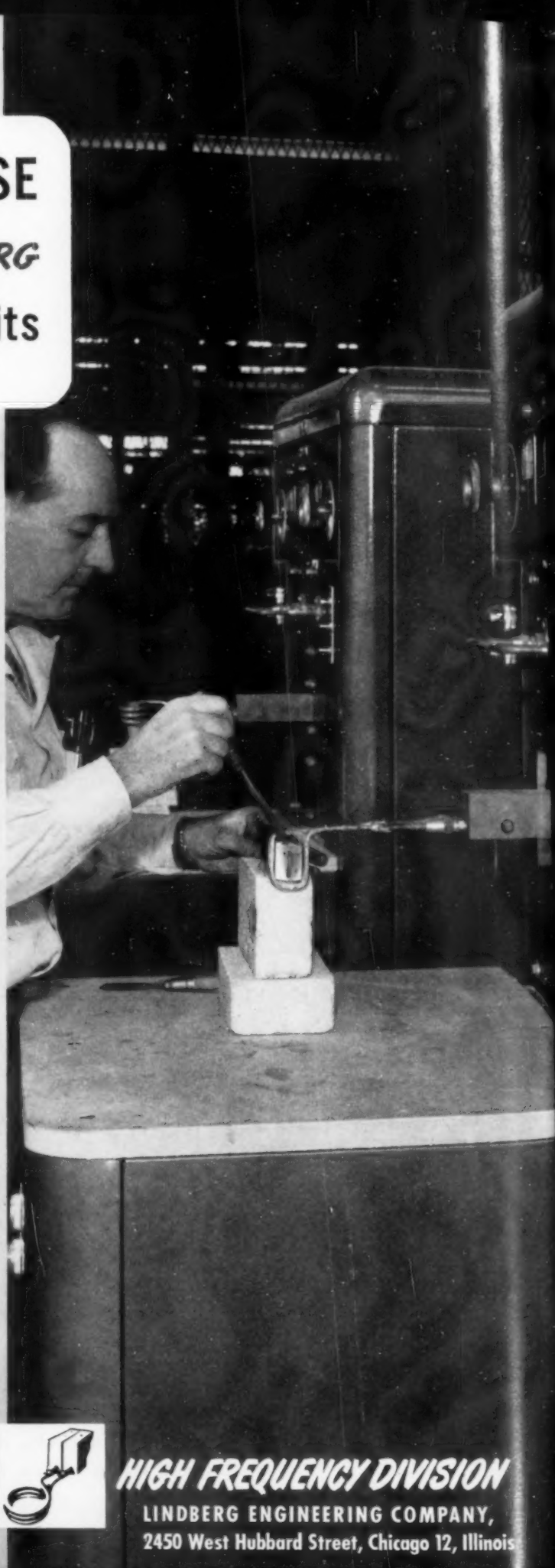
Investigate Lindberg Induction Heating Units. Ask for Bulletin 1440.

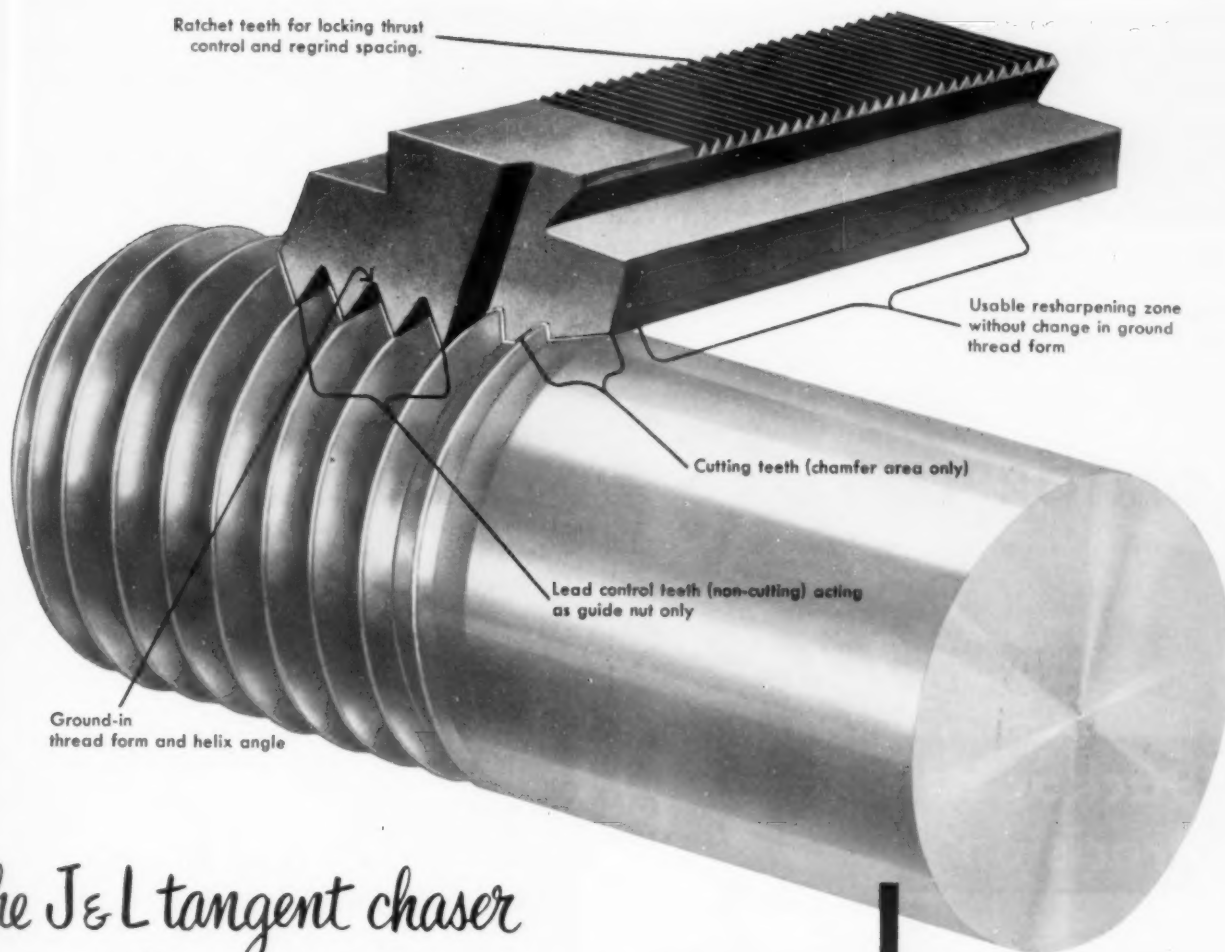
LINDBERG



HIGH FREQUENCY DIVISION

LINDBERG ENGINEERING COMPANY,
2450 West Hubbard Street, Chicago 12, Illinois

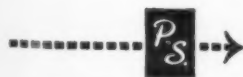




the J&L tangent chaser threading System assures...

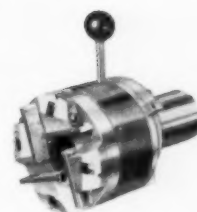
... ease of operation ... maximum accuracy and tool economy — by means of a true tangent method of thread cutting exclusively developed by Jones & Lamson.

All four chasers in the set are positioned tangent to the work, making them cut like any other end cutting form tool. J&L tangent chasers have the thread form ground in at the exact helix angle for the size and pitch being threaded. Cutting action is confined to the chamfered area and the first full tooth in a set. The non-cutting teeth, purposely end ground above center, act as a precision lead nut. The non-cutting teeth on all four chasers act as a steady-rest and help control the lead with extreme accuracy. Class III guaranteed. *This means important savings regardless of your tolerance requirements.*



J&L Automatic Opening Die Heads and Chasers assure low initial cost — ease of operation — controlled resharping — use of carbide where applicable. Class III threads guaranteed.

Write for free copy of new Jones & Lamson Tangent Die Head OPERATOR'S MANUAL.



Tangent Stationary Type
Capacities from #4 to 2"



Tangent Revolving Type
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Brown & Sharpe Types,
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#0 & #2 B&S machines &
small turret lathes.

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June 1954



Machine Tool Craftsmen
Since 1835

THREAD TOOL DIV.

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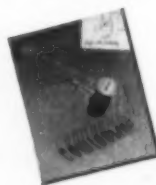
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Here in a compact, self-contained unit you have the high precision that has found a prominent place in the jet engine program, the automatic transmission program and other fast moving set-ups. Used at machine or bench, Comtorplug has self-aligning features assuring accuracy. Ideal for Statistical Quality Control programs. Comtor Co., 69 Farwell St., Waltham 54, Mass.

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With Interchangeable Expansion Plugs from 1/8" to 8" dia.



For gaging high-precision holes to fractions of .0001"

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Production



ROUSSELLE
Presses!



It took some concentrated planning, stressing ruggedness and simplicity, along with accurate machining and "close-tolerance" assembly, to bring out these fast, rigid, high output units—THAT COST SO LITTLE—DO SO MUCH—REQUIRE SO LITTLE MAINTENANCE.

In addition to metal forming, bending, shearing, notching, and piercing, they are also adaptable to cutting and punching paper, forming and cutting fibre, plastics, etc.

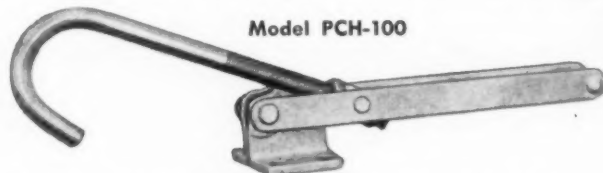
Often considerable savings are possible if you let our engineering staff assist you. There is no obligation. Simply explain the problem and send sample or drawing of work.

Russelle Presses are Sold Exclusively through Leading Machinery Dealers and are manufactured by

SERVICE MACHINE CO.

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USE READER SERVICE CARD; INDICATE A-6-318-2



Model PCH-100

THIS NEW CLAMP

will simplify and speed your operations requiring pulling action.

This new clamp—a hook clamp—may have the answers to many of your problems—specifically where tension and sustained holding power is needed.

Save physical strength and time—simplify pulling jobs. Originally developed for aircraft industry, this unusual clamp can bring help to many other industries. Maybe yours!

Don't exert human strength; do the job mechanically. You can build up a great pulling force through the toggle action of this Knu-Visc clamp—quickly and easily.

We'll tell you more without obligation. Send for complete information.

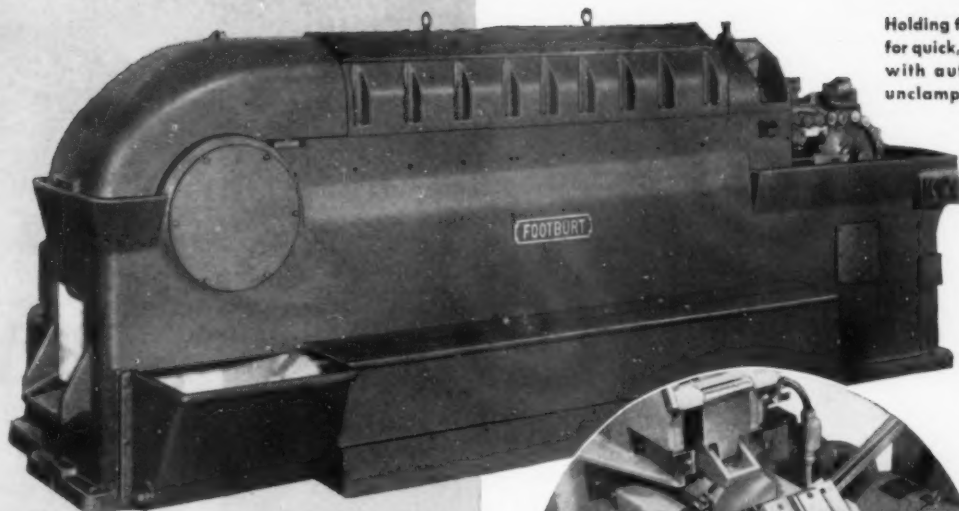
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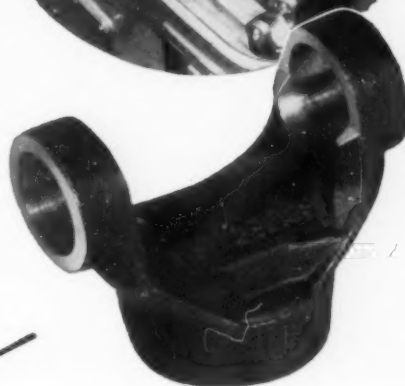
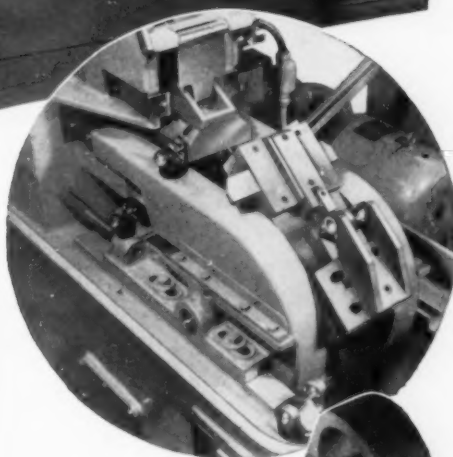
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Holding fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

to cut machining costs
machine faster with

**CONTINUOUS
BROACHING**



• Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building

*★engineered
for
production*

FOOTBURT
MACHINE TOOLS

June 1954

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-6-319

319



UNBRAKO button head socket screws are used exclusively to assemble this controlled volume pump, which was designed to fill the growing industrial need for the pumping of an allotted quantity of liquid at higher pressures, higher capacities.

Save inventory dollars

Use UNBRAKO Standards—stocked by your distributor

Not only does your UNBRAKO distributor lower inventory investment, he also saves you time—and provides latest information about products, cost-saving methods, production techniques, current problems, trade practices. For latest data on UNBRAKO standard socket screw products, consult him or write STANDARD PRESSED STEEL COMPANY, Jenkintown 37, Pennsylvania.



The assembler inserts the UNBRAKO button head socket screw with his fingers, and runs it down as far as he can.



He then tightens it with a standard UNBRAKO key. Once seated, the low head design of the UNBRAKO button head provides a smooth, streamlined appearance.



UNBRAKO Button Head Socket Screws are made of heat treated alloy steel; have fully formed threads, Class 3 fit; are available in standard sizes from # 8 to $\frac{1}{2}$ ". Accurate hex socket provides nonslip drive, prevents marring or mutilation of the head.



SOCKET SCREW DIVISION



JENKINTOWN PENNSYLVANIA



Self-Locking Set Screw



Flat Head Cap Screw



Shoulder Screw



Dowel Pin



Knurled Head Cap Screw

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WESSON
Cutting Tools
ENGINEERED FOR CARBIDE

WESSONMETAL
Carbide Blanks
A Tip To Quality

WESSON'S UNIQUE METHOD OF CONTROL GIVES YOU THE PERFECT UNIFORMITY THAT MAKES

WESSONMETAL

The Outstanding Metal Working Carbide!



YOUR WESSON TOOL ENGINEER
HAS ACTUAL CASE HISTORIES TO
PROVE THAT WESSON CONTROL
ASSURES UNIFORMITY AND HIGHER
PRODUCTION IN ALL TYPES OF
METAL WORKING...ASK TO SEE
THESE REMARKABLE REPORTS



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More resistance
to transverse rupture

Wider modulus
of elasticity

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Accurate hardness

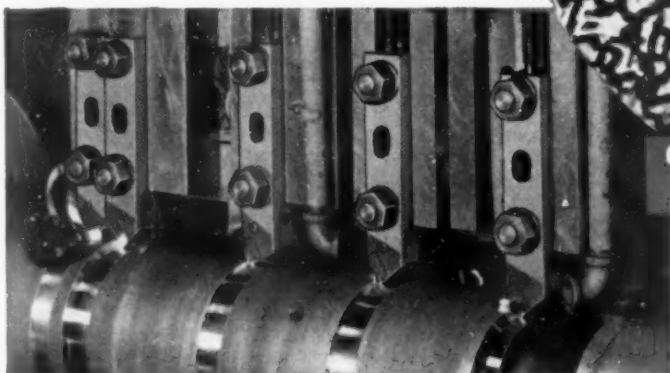
Greater compressive
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Minimum thermal
expansion

Greater tensile
strength (PSI)

Greater oxidation
resistance

NOTE: Microphoto shown is of special
Wessonmetal grade.



Wessonmetal is a superior metal working carbide because Wesson Metal-
lurgists, with over 30 years of thorough training and practical experience,
have pioneered and developed scientific quality controls unique in the carbide
industry. The result is an exceptional uniformity of grade that keeps ma-
chines producing. The growing list of case histories in the Wesson files
prove the dependability of Wessonmetal.

Ask the Wesson man in *your area* to show you these outstanding per-
formance stories. He probably has several that apply to *your job*.

See "THIS
CARBIDE AGE"
educational
color-sound
movie on
the history
of carbide.

Solid carbide
blades, blanks,
formed shapes

Solid
carbide inserts

WESSON METAL CORPORATION

LEXINGTON 34, KY.

Affiliated with WESSON COMPANY, Detroit, Mich.



Just 1 hand operates this amazing Wrench!

**Trigger ON—
Trigger OFF—
No knurls to
fumble with!**

With the **ONLY** Instant, Speed-Action "Fractional," Ratchet-Action, Non-Slip Grip that insures safety! TRIG-O-MATIC'S "automatic eye" adjustment control assures positive, easy, non-slip 1-Hand operation...It automatically grips and releases on pipes, nuts, and fittings.

Here's the first real development in wrench history. An amazing wrench that's made for efficient 1-Hand operation — eliminating clumsy 2-Hand fumbling. Exclusive, self-adjusting Trigger adjustment requires only one hand on the handle to set and release jaws. A Time-Saver! Ideal for work in cramped quarters!

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- 1 hand on handle sets and releases jaw grip—no knurls to fumble with.
- Bull-dog teeth that "bite-in" and HOLD!
- Will not strip off galvanized pipe.
- Replaceable jaws insure life-time use.
- Now available in 3 Popular Sizes:
 - 9" opens 1/4" to 1 1/4"
 - 12" opens 1/2" to 1 3/4"
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Larger sizes will be available

RESPONSIBLE DISTRIBUTORS WANTED! We solicit your inquiries.

TRIG-O-MATIC

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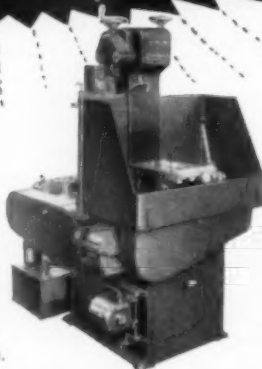
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IN PRICE AND
VALUE

It's the NEW

MICRO LOCK

QUICK CAMLOCK
+
MICRO FINE ADJUSTMENT COMBINED

made by the
FAMOUS



SPECIFICATIONS

Total Length: 9" - Measuring Capacity: 6" - Graduations: 1/1000" & 1/128" - Code Word: GINDO

Without detachable Height Gauge Base and Scriber — \$25.50

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TOOLHEAD**

A Boring Head that Won't Face is Not Complete

Write today for **CHANDLER TOOL CO.**
complete details. MUNCIE, INDIANA

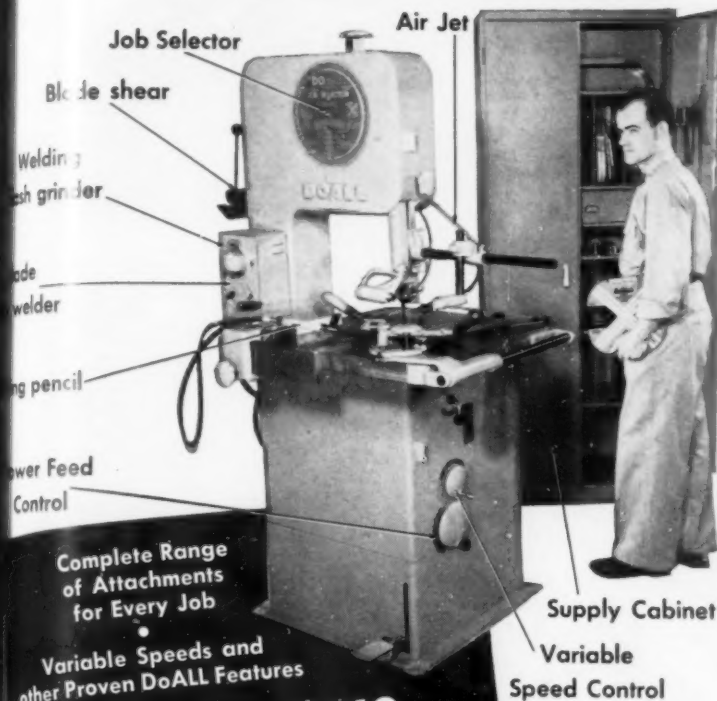
COMBINED BORING & FACING TOOL HEADS
Chandler-Duplex

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TODAY APPEARING IN THIS ISSUE OF THE TOOL
ENGINEER, USE THE HANDY READERS SERVICE
CARD ON PAGE 141.

The Tool Engineer

DoALL Announces A NEW LOW COST 16" CONTOUR MACHINE



As Low as \$540

Now Any Plant Can Afford The Advantages of a DoALL!

HERE IS the greatest value ever offered in a 16" x 12" capacity multi-purpose contour saw: for toolroom and light production work . . . automatic power feed . . . fixed and variable speeds of 50 to 5200 blade feet per minute . . . for sawing, friction sawing, filing, polishing, carbide tool finishing.

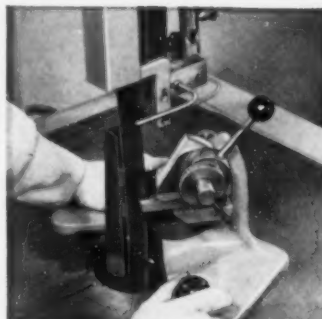
There are five models, starting at \$540 (less motor, starter and attachments). *You save money* because you do not have to buy more machine than is needed for the job. *You get more for your money* because these machines have DoALL quality and DoALL versatility through and through.

And, never before have machines in this size and price class been available with such a great variety of attachments. There is no class of work within their range which cannot be handled faster and at lower cost with these new DoALL's.

Ask for a demonstration in your own plant. Call your local DoALL Service-Store, or write:

The DoALL Company, Des Plaines, Ill.

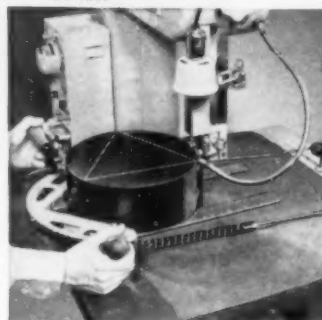
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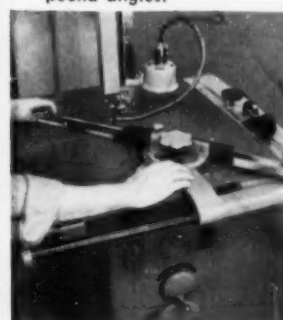
NEW carbide tool finishing attachment with abrasive bands!



TILTING table plus mitering attachment produces compound angles.



HEAVY work slide attachment with power feed reduces fatigue, speeds work.



CUT-OFF and mitering attachment provides precision accuracy, speed.



RATCHET feed and work-holding jaw for ease and speed.



DISC cutting attachment produces perfect circles fast and easily.



RIP fence makes fast, precision cutting a simple job.



FILING—internal or external with DoALL file bands.

8-20

Call
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See classified
phone directory
for DoALL Store
nearest you.



Machine Tools . . . Cutting Tools . . . Gages . . . Supplies

**See this
New DoALL in Operation**

**Ask For Free Demonstration
at your Plant—
No Obligation**



**Before You
Buy any Air-Gage**
you should know
these 4 facts about a
T-P CompAIRator

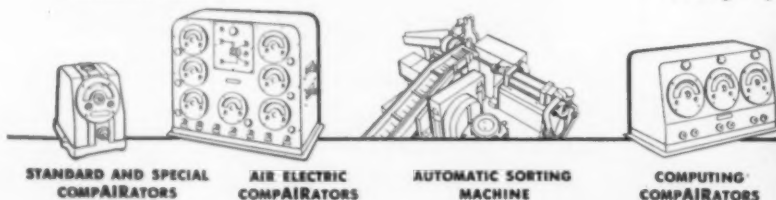
1. It's Faster! There's no flutter nor falling off of the pointer. No guesswork required. Readings are virtually instantaneous *even when long extension hoses are used.*

2. More Versatile! No other air gage matches the instant accuracy of this velocity-type circuit for such a wide variety of applications — from simple internal diameters to simultaneous checks of concentricities, squareness, center distance, etc. — bellmouth or barrel shapes.

3. It Costs Less to Operate! Vibration, hard knocks, jarring — even tilting — do not disturb the accuracy of a T-P CompAIRator. Its rugged construction eliminates expensive maintenance.

4. It Has A Wider Range! A T-P CompAIRator can be simply, quickly applied to check any dimensional relationship — even down to internal diameters as small as .055" . . . tolerances from .0001" to .120". No other air gage approaches this range. It means wider application, greater usefulness, more gaging for your money.

Before you buy any air gage you'll want to talk over these advantages with a Taft-Peirce sales engineer. Discover the dollars and sense savings a T-P CompAIRator can make for you. Write today. (And ask for descriptive Handbook.)



STANDARD AND SPECIAL
COMPAIRATORS

AIR ELECTRIC
COMPAIRATORS

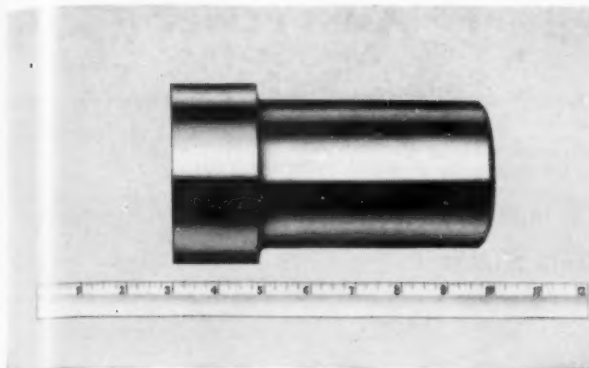
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MACHINE

COMPUTING
COMPAIRATORS

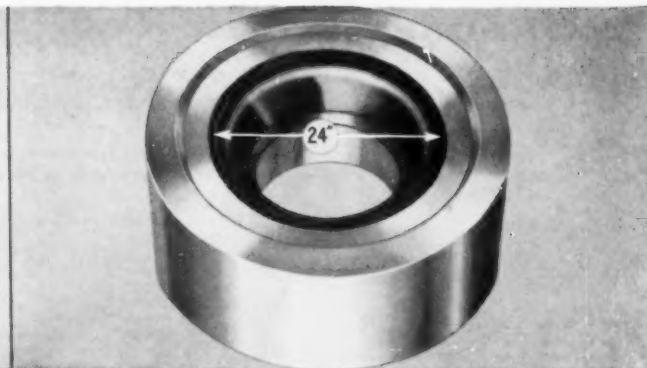
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Top Precision*



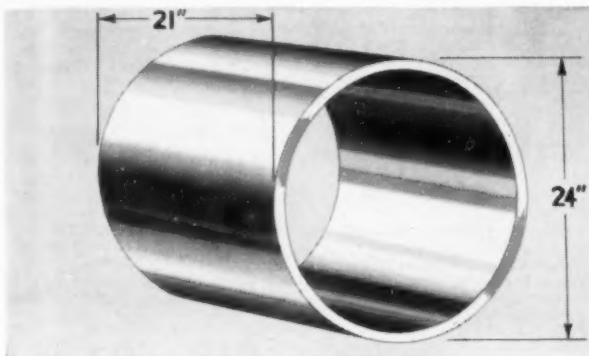
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND



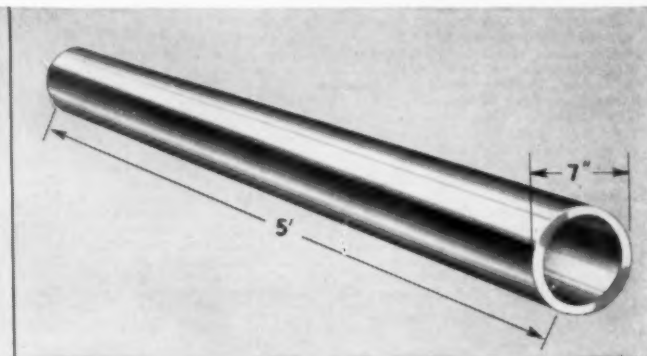
Solid carbide punch used in the cold extrusion of steel.



Ring dies up to 24" I.D. produced one piece.



Carbide cylinders up to this size produced one piece.



Carbide cylinders up to this size produced one piece.

2-Ton Cemented Carbide pieces can solve your toughest wear problems

New manufacturing facilities at the Carboloy Department of General Electric Company are capable of producing pieces of cemented carbide up to 4,000 pounds, including —

- large die sections
- rolls for rolling strip steel
- large punches for cold extrusion work
- large, wear-resistant linings for brick molds

When you replace present parts—large, medium size or small, with Carboloy cemented carbides, maintenance costs come down, production goes up.

Carboloy engineers are ready to assist manufacturers and diemakers to determine where and how Carboloy cemented carbides can cut costs, boost production. Write for this free service.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Carboloy, Department of General Electric Company
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Please have a Carboloy engineer —

- ☐ call at plant.
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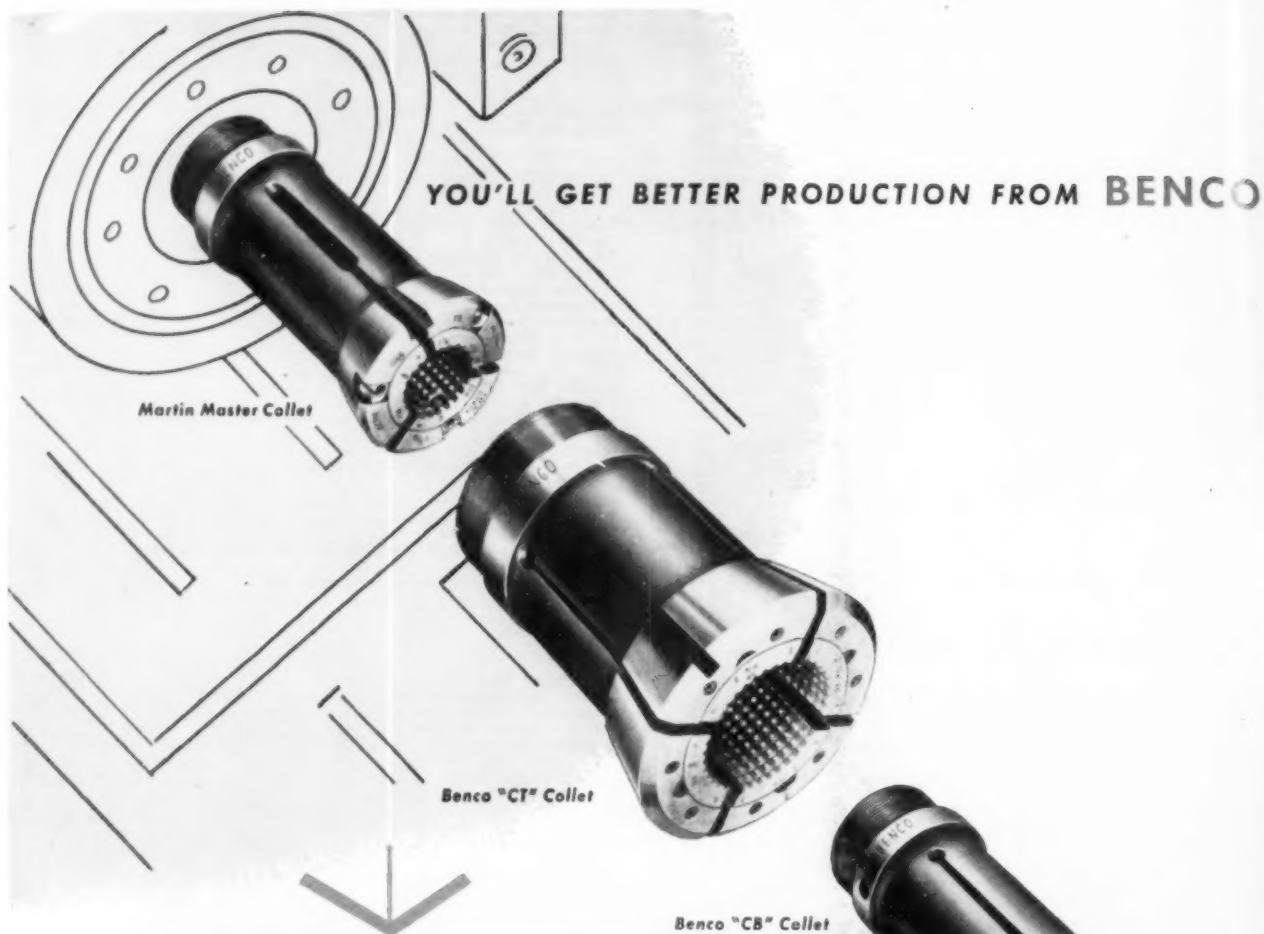
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**add extra capacity to your machines
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Pads on Benco Master Collets can be inserted without removing collets from spindle... they are held securely... never work loose during operation.

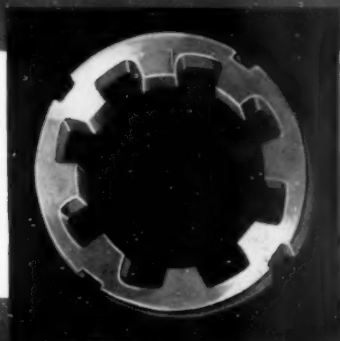
Precise heat treating of special oil hardened steel and careful inspection combine to assure long, trouble free performance. Cam grinding on the taper provides easier, quicker operation in the chuck head. For simple or difficult jobs, Benco Master Collets are far better, yet cost you less in the long run. Get Benco Collets now... watch the difference in performance.

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**REMOVE STOCK TO
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Continental

TOOL WORKS



**DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN**



Don't Get Caught Without a Spindle

**WHEN PRECISION
DEMANDS
AIR GAGING**



Be protected with a **SHEFFIELD ADJUSTABLE BALLJET SPINDLE KIT** against an accident, an unexpected engineering revision, an oversight in a tool order. You'll be ready, too, to gage those small runs of high precision parts.



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In 5 minutes you can assemble from the Kit a spindle for any size within a range of one to three inches and set it to size with the Size Setting Gage. Four spindles of various sizes can be placed in use simultaneously.

NO MASTER SETTING RINGS NEEDED

To assemble and use these spindles, you need only an air gage and the equipment illustrated in the Kit plus a set of standard gage blocks—nothing else—not even one master setting ring. The air gage is calibrated by using the standard calibrator illustrated.

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Standard Calibrator



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